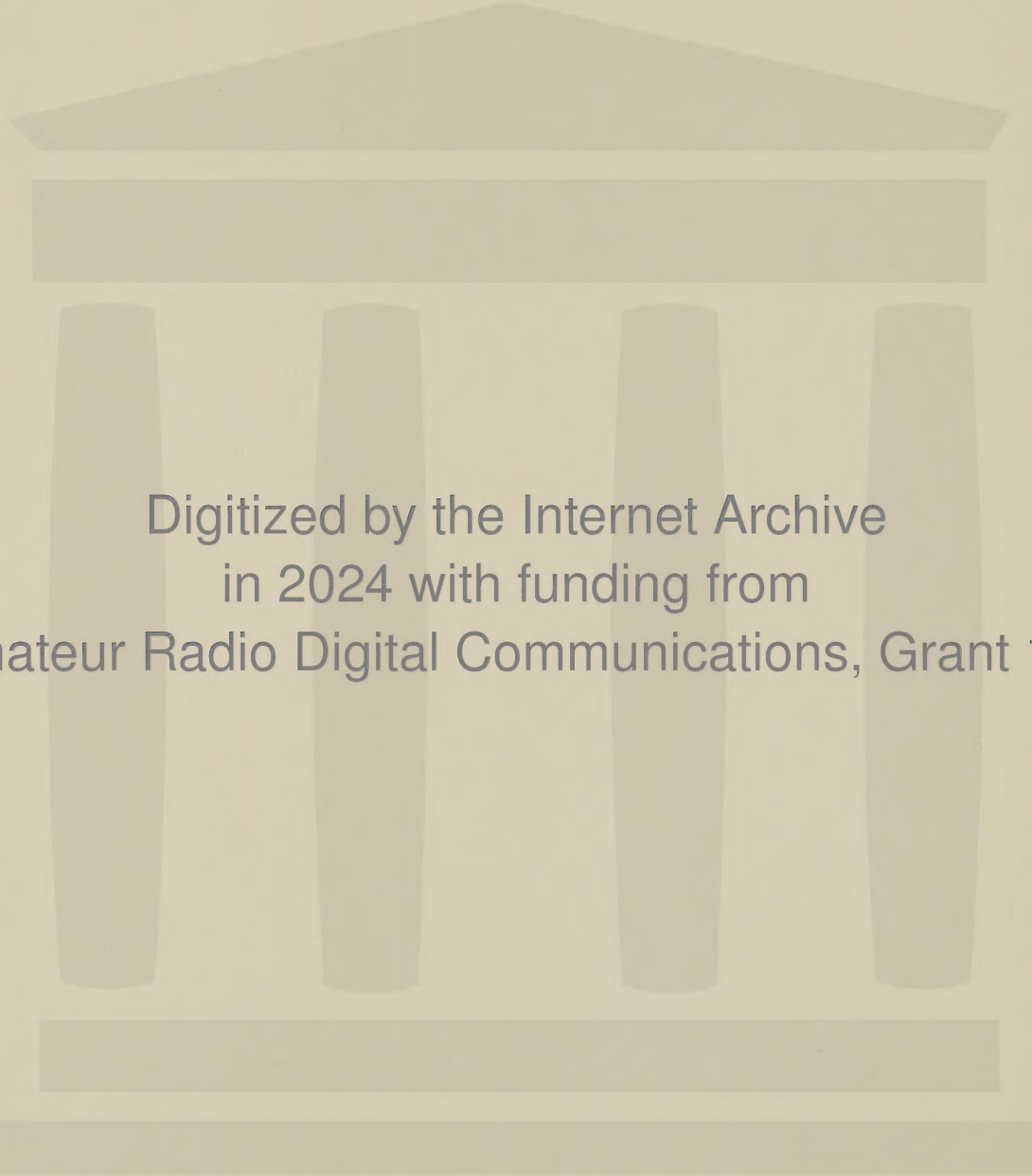


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RF-4950 CONTROL UNIT TEST SET OPERATOR'S GUIDE



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HARRIS
COMMUNICATION AND
INFORMATION PROCESSING

PM-1422

SYSTEM PRACTICES RF-4950 CONTROL UNIT TEST SET OPERATOR'S GUIDE

CHAPTER 1	GENERAL INFORMATION
CHAPTER 2	OPERATION
CHAPTER 3	CONTROL UNIT TESTS
CHAPTER 4	MISCELLANEOUS

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RF-4950 CONTROL UNIT TEST SET OPERATOR'S GUIDE

CHAPTER 1 GENERAL INFORMATION

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1. SCOPE

1.01 This manual contains operating instructions for the RF-4950, a test set that provides "go/no-go" testing of several Harris mobile telephone control units (see table 3-1). Using this test set, a technician can rapidly isolate problems in a faulty control unit or quickly verify correct operation.

1.02 The instructions for control unit testing are in two parts, automatic and manual. The automatic test sequence steps through the test as long as the results are valid. The manual mode requires an operator to step through each test sequence manually. In this mode, faults can be identified more precisely for detailed troubleshooting. Repairs can then be made with the aid of the maintenance manual, PM-1433.

1.03 This manual also includes a procedure for checking the operation of the test set itself. In case of a malfunction, this self-test procedure allows an operator to identify probable faults in the test set.

1.04 A general theory of operation is also covered, while service and repair procedures for the test set are given in a separate manual, PM-1433.

2. SPECIFICATIONS

2.01 The RF-4950 Control Unit Test Set is mounted in a rugged attache-type case that facilitates field operation (see figure 1-1). The cover may be removed for bench testing of control units.

A. Physical

Size: 18W x 12L x 7H in. (45.7W x 30.5L x 17.8H cm)

Weight: 20 lbs. (9.1kg)

Environmental: -10°C to +45°C; 90% R.H. @ 45°C

B. Electrical

Power Input: 115/230Vac, 50/60Hz or 12.5 to 15V dc, 100 watts maximum

Control Unit Power Output: 12.6Vdc \pm 20% @ 2 amps maximum

Input Tone Acceptance: 2805Hz \pm 10Hz

2150Hz \pm 22Hz

1633Hz - 20 +8Hz

1500Hz \pm 5Hz

1336Hz \pm 16Hz

Input Signaling Acceptance: a. 2150/1633/1336Hz IMTS per table 4-3
b. 1402.5Hz SMART ANI

Input Level: 0.5V rms minimum

Output Signaling Rate: 16 PPS nominal

Output Signaling Modes: 2000/1800Hz IMTS

1500/600Hz MTS

1500Hz RCC

2805Hz RCC

Output Level: (High Level) 0-1Vrms minimum

(Low Level) 0-0.1Vrms minimum

Output Tone Tolerance: ± 1 Hz maximum

Output Tone Stability: Exceeds 0.3%

3. CAPABILITIES

- Automatic and/or manual testing of the following control units: RF-4911, RF-4910, RF-4912, RF-4940 (Alpha 40 Series), RF-494A (SECODE VP-4 with ANI), RF-494B (SECODE VP-4 without ANI), RF-495 and RF-495M (SECODE VP-1 and VP-2 respectively).

- Provides automatic indication of faulty control units by visual and/or aural means.
- Allows use of an external audio signal generator.
- Contains a 0-20Vdc meter with external connections as an aid to troubleshooting. The test set need not be powered to operate the meter (see self-test section).
- Tests control units while the unit remains installed in the vehicle (uses vehicle power, 12Vdc).
- Completely self-contained.
- Fully simulates the operation of mobile telephone terminal tones and the vehicle's transmitter/receiver to test the control unit.
- Uses 115/230Vac, 50/60Hz for bench testing and repair of control units and verifies repair is correct and complete.



Figure 1-1. RF-4950 Test Set Attache Case

RF-4950 CONTROL UNIT TEST SET

OPERATOR'S GUIDE

CHAPTER 2

OPERATION

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1. INTRODUCTION

1.01 The RF-4950 Control Unit Test Set provides two separate sequences of operation: automatic and manual. In the automatic sequence, test functions are performed by the test set in a continuous manner until an error occurs or that portion of the test is com-

plete. In manual sequence the test does not proceed to the next step until the operator instructs the set to do so by pushing a button. Manual sequence operation is primarily intended for bench testing and troubleshooting.

Note: The term manual is used in two different contexts in the testing of control units. Manual Mode refers to operation of the **control unit**. Manual Sequence refers to a setting or procedure of the **test set**.

2. CONTROLS AND INDICATORS

2.01 A functional description and physical location of the controls and indicators on the front panel are listed in table 2-1 and shown in figure 2-1.

TABLE 2-1

CONTROLS AND INDICATORS

Control or Indicator	Function Description
Audio Section	
Voltmeter	Measures amplitude of audio input/output signals in rms voltage. When SELF-TEST switch is set at VOLTMETER (Scale 0-20V) position, the meter is a 0-20Vdc voltmeter with terminals for external leads provided on the interconnections section. Power to the test set is not required to operate the meter.
Speaker	Monitor for audio signals going to or coming from the control unit.
VOLUME Control	Controls volume of speaker audio.
CONTROL HEAD AUDIO OUTPUT-BASE STATION AUDIO OUTPUT TOGGLE Switch	Switches the speaker and voltmeter between audio output and audio input monitoring.

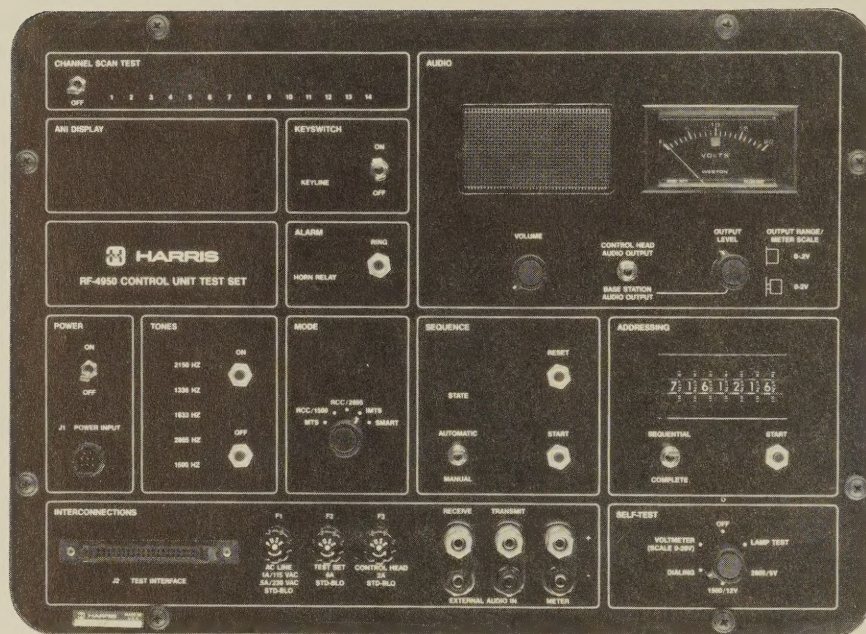


Figure 2-1. Front Panel Controls and Indicators

TABLE 2-1 (Cont'd)
CONTROLS AND INDICATORS

Control or Indicator	Function Description	
OUTPUT RANGE/METER SCALE Push-Pull Switch	Switch Position	Full Scale Range of Voltmeter
	In	0-0.2 V
	Out	0.02 V
NOTE: The audio output is reduced by a factor of 10 when the switch is pushed in. Normal operating position is out, 0-2.0 Vac, position.		
OUTPUT LEVEL Control	Adjusts audio output from 0 to 2.0Vac.	
Addressing Section		
Seven Digit Thumbwheel Switch Assembly	Used to address the telephone subscribers number of the control head. A blank position is provided for each digit to allow an address of less than seven digits, i.e. leading blanks are not dialed.	
SEQUENTIAL COMPLETE Toggle Switch	<u>Switch Position</u>	<u>Function</u>
	COMPLETE	Selects operation of the test set to dial automatically the complete number programmed by the thumb-wheel switches.
	SEQUENTIAL	Permits the test set to dial the programmed number one digit at a time. The START pushbutton must be depressed once for each digit.
START Pushbutton Switch	When toggle switch is set at COMPLETE, depressing START button starts full cycle of automatic dialing. When toggle switch is set to SEQUENTIAL, depressing START button advances the test one step or dials one digit. For manual sequence only.	
Sequence Section		
AUTOMATIC/MANUAL Toggle Switch	Allows automatic or manual operation of the test set.	
START Pushbutton Switch	Starts the automatic sequence of control unit testing (not used in manual sequence).	
RESET Pushbutton Switch	Overrides test sequence and resets display to "00".	
Two Digit State Display	Indicates step number of the automatic test sequence the test set is performing. Steps in the sequence may show correct operation or a fault condition.	

TABLE 2-1 (Cont'd)
CONTROLS AND INDICATORS

Control or Indicator	Function Description
Tones Section	
ON Pushbutton Switch	When depressed, initiates proper audio tone for manual sequence.
OFF Pushbutton Switch	When depressed, turns off tone.
Indicators: 2150Hz 1336Hz 1633Hz 2805Hz 1500Hz	When illuminated indicates that frequency is present and within specifications. May be used for adjustment purposes in the control unit.
Power Section	
ON/OFF Toggle Switch	Turns on ac or dc primary power to the test set and dc power to the control unit.
Keyswitch Section	
ON/OFF Toggle Switch	For either automatic or manual sequence, replaces control unit key-switch lockout feature to power the control unit manually.
KEYLINE Indicator	When illuminated, the control unit is providing a keyline closure to key the transmitter.
Alarm Section	
RING Pushbutton Switch	For manual sequence only. When pressed, initiates ring command tone sequence to control unit.
HORN RELAY Indicator	When light is on, indicates control unit is activating an external alarm device.
Channel Scan Test Section	
OFF Toggle Switch	When OFF, inhibits scan test. When on, checks ability of the control unit to lock on idle tone channel (always channel 1).
Channel Indicator Lamps 1 through 14	Visual monitor of selected channel(s) of control unit. Indicator lamps will not necessarily sequence in order of channels selected on the control unit.
ANI Display Section	
Eight Digit Display	Displays seven digit address of the addressing thumbwheels or number pre-programmed in the control unit. Eighth digit is used with SMART ANI.

TABLE 2-1 (Cont'd)
CONTROLS AND INDICATORS

Control or Indicator	Function Description	
Mode Section		
Mode Selector Switch	Enables test set to test various types of radiotelephone control units.	
	<u>Switch Position</u>	<u>Type of Control Unit</u>
	MTS	Mobile Telephone Service
	RCC/1500	Radio Common Carrier 1500Hz
	RCC/2805	Radio Common Carrier 2805Hz
	IMTS	Improved Mobile Telephone Service
	SMART	RCC/2805 with ANI
Self-Test Section		
	Turns off control unit testing to allow self-testing of the test set.	
Self Test Selector Switch	<u>Switch Position</u>	<u>Test Set Response</u>
	OFF	Turns off self-test functions to allow control unit testing.
	LAMP TEST	All panel lamps are on except ANI display. The sequence state display is at .8.8.
	2805/5V	Checks encoder/decoder and +5Vdc supply.
	1500/12V	Checks encoder/decoder and +12Vdc supply.
	DIALING	Checks dialer assembly, ANI display and thumb-wheel.
	VOLTMETER (Scale 0-20V)	Changes the voltmeter in the AUDIO SECTION from ac to dc and allows 0-20Vdc metering from external lead connections. The test set does not need to be on to use the voltmeter in this position.

3. TEST SET-UPS

3.01 When testing a control unit installed in a vehicle, the test set operates on 12Vdc; when used for shop testing of control units, the test set utilizes ac power. See figures 2-2, 2-3, and 2-4 for typical connections. For dc power, use cable 6616-0010 and for commercial ac power, use cable 6616-0020. To operate from a 230Vac line, change the jumpers on the power transformer. Use jumpers A and C for 115Vac and jumper B for 230Vac.

4. GENERAL OPERATION

4.01 The RF-4950 test set simulates the base station terminal and the mobile transceiver portion of the radio-telephone system. The test results may be used to determine whether a problem exists in the control unit and, if so, where the problem is located. After repairs have been made, the control unit should be checked again for satisfactory operation.

4.02 When simulating the mobile receiver and base station, the test set determines if the control unit is on and scanning available open channels. In an IMTS system, the test set generates idle tone (2000Hz) causing the control unit to lock onto a channel. A lamp will turn on, an rms voltage will be indicated, and an audio signal will be emitted from the speaker when reception of idle tone by the control unit is confirmed. The correct signal level input to the control unit can then be set.

4.03 Units having ANI (automatic number identification) are programmed with a unique number that will be displayed automatically by the test set. For testing control units without the ANI feature this number must be otherwise known.

4.04 The test set produces tones that simulate a base station and, in turn, will receive and visually display the control unit's transmission of guard tone, connect tone, and at the completion of decoding, disconnect tone. The signals are heard through the speaker and the levels shown on the ac voltmeter. A lamp indicates when the control unit is keying the transmitter and prepared for normal conversation.

4.05 When the correct number of the control unit is dialed on the thumbwheel switches in the addressing section, the control unit will ring. The alarm system of the control unit may be checked at this time and confirmed by the HORN RELAY lamp and by

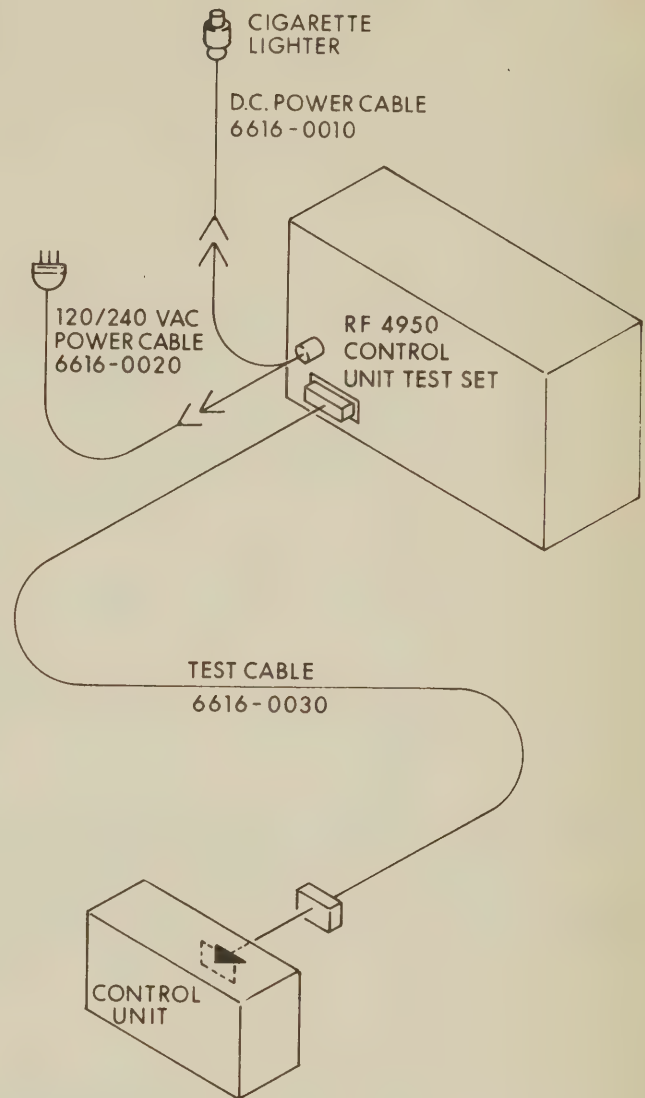


Figure 2-2. Test Set Connection to RF-4910/11/12 Control Units

an audio signal from the test set speaker. When the call is answered by the control unit (handset off-hook) and the correct state achieved on the test set state display, the audio level transmitted by the control unit may be checked on the ac voltmeter.

4.06 The test set confirms correct operation of the control unit when it initiates a call (mobile to base). With the handset removed, the correct signal sequence by the control unit will result in a dial tone in the handset earpiece. When numbers are dialed by the control unit, a visual indication of dialing is presented by flashing lights on the test set. To check the number being sent, the dial is allowed to return

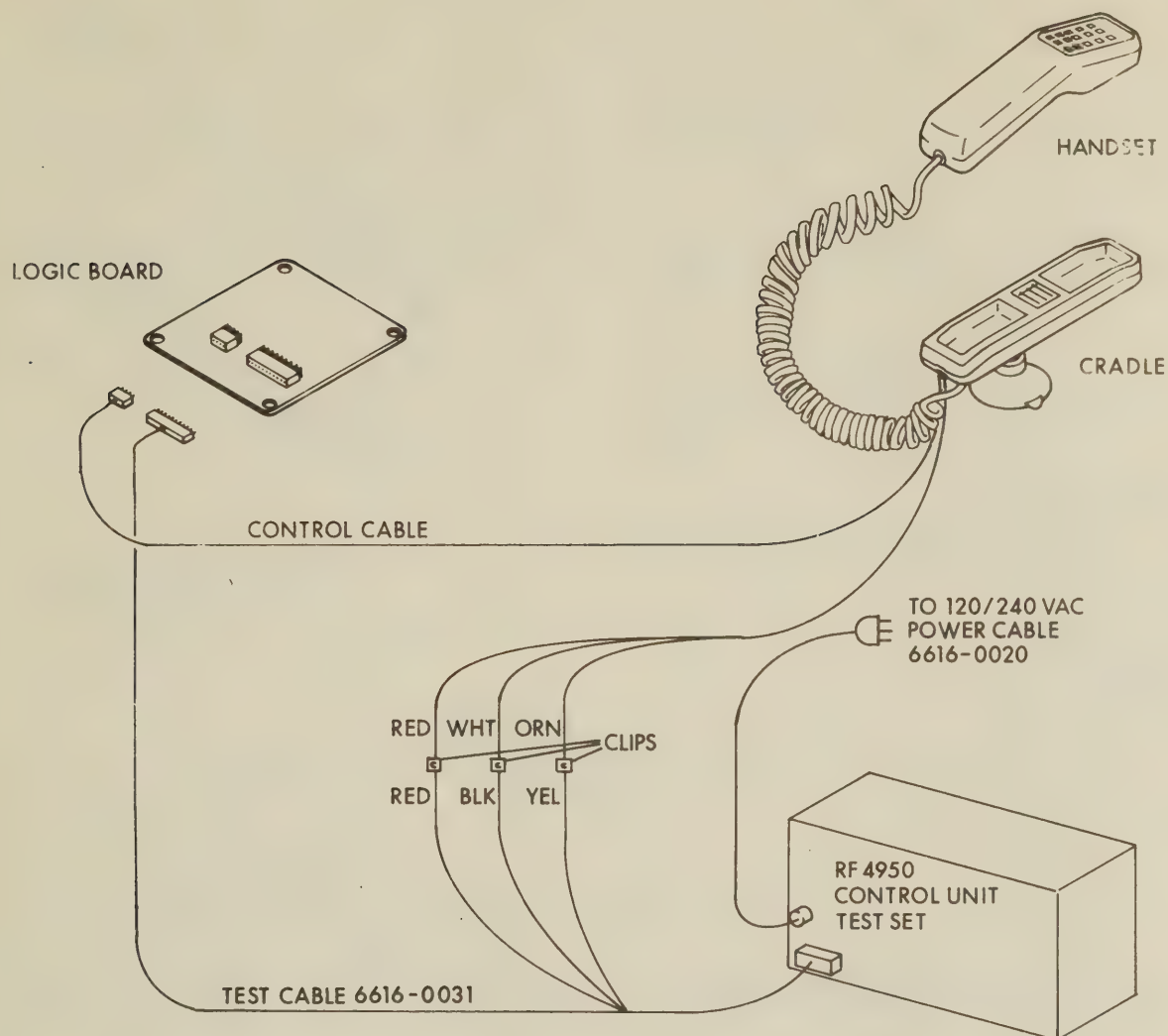


Figure 2-3. Test Set Connection to Alpha 40 Series (RF-4940) Control Unit (Bench Testing).

slowly to its stop, and the number of flashes counted. With units requiring operator assistance, the test confirms that the correct signal has been sent to connect the operator. The speech level may be monitored by the voltmeter in either case.

4.07 When the handset is replaced on the control unit (on-hook), the correct disconnect sequence for IMTS units is indicated by the STATE display returning to "00". For other units this is indicated when the KEYLINE lamp turns off.

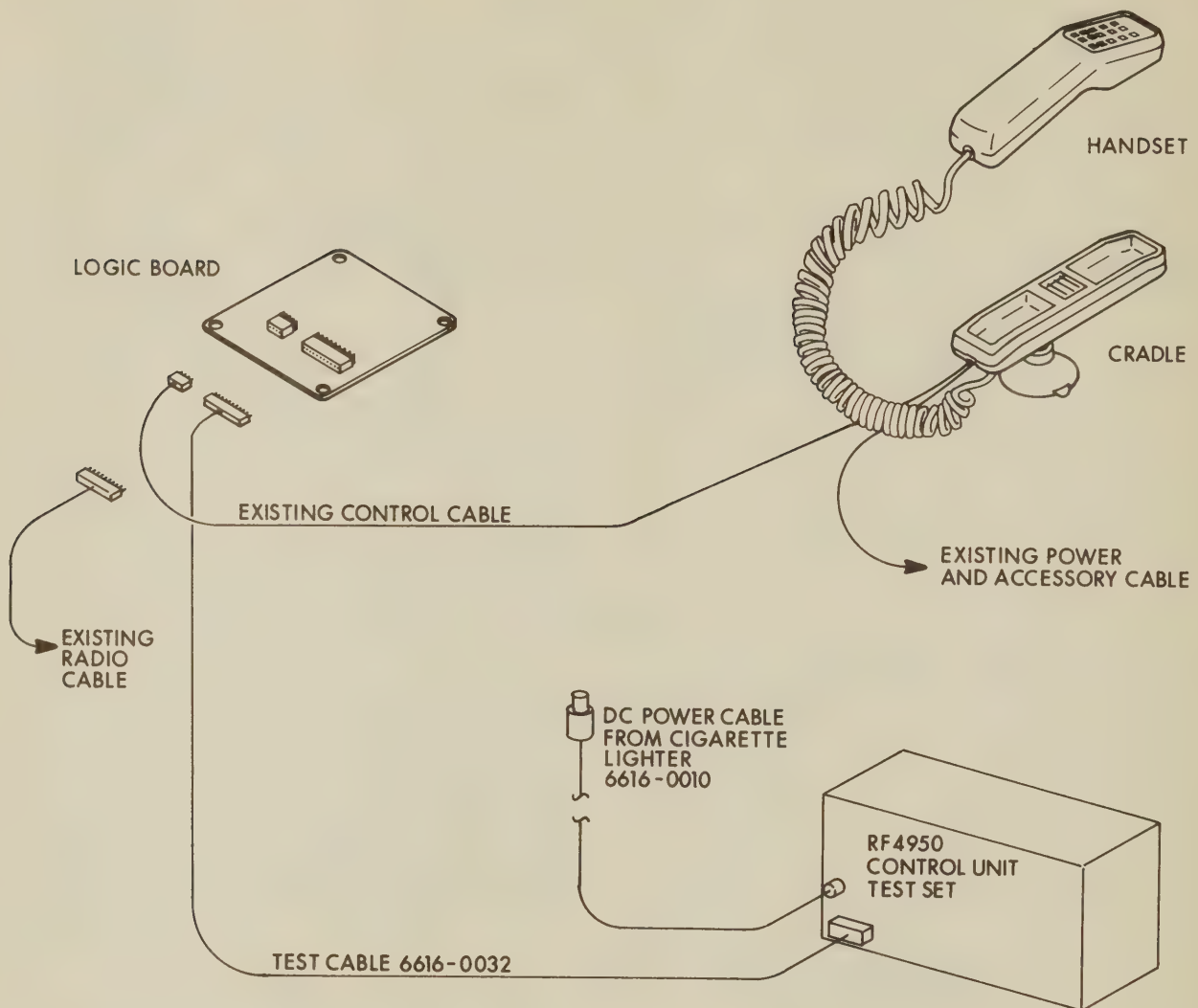


Figure 2-4. Test Set Connection to Alpha 40 Series (RF-4940) Control Unit (In-Vehicle Testing)

5. SELF-TEST PROCEDURE

5.01 Table 2-2 indicates the procedure for confirming correct operation of the test set. Possible malfunctions are listed and an indication is given of the suspected source of a problem. This procedure should be performed with the test set disconnected from the control unit to be tested. If an RF-4910, 4911 or 4912 unit is connected to the test set during the self-test procedure, the handset must be removed from the cradle (off-hook). If this is not done and LAMP TEST

is selected, a protection circuit in the control unit will draw excessive current and blow fuse F2.

6. CONTROL UNIT/TRANSCIVER TESTS

6.01 It is possible to modulate a signal generator with the base station tones produced by the RF-4950 Control Unit Test Set. Connect test leads from the "RECEIVE EXTERNAL AUDIO IN" binding posts to the external modulation input of the signal generator. The "OUTPUT LEVEL" control will set the level of this output.

TABLE 2-2
SELF-TEST PROCEDURES

Operator Actions	Expected Results	Test Analysis and Error Indication	Source of Fault
1. Connect test set to power source. Set POWER switch to the ON position.	SEQUENCE STATE display illuminates with number "00".	Another number different from "00" appears on SEQUENCE STATE display.	Power ON reset circuit on control board malfunctioning. Turn set off, then on.
		No number appears in SEQUENCE STATE window.	If ac power source is used, F1 may be blown. If dc power source is used, F2 may be blown. F4 (internally located on power supply board) may be blown due to power supply malfunction. Power supply malfunction.
			Check for +12 and +5Vdc with steps 3 and 4 of this procedure.
2. Set MODE switch to IMTS. Set SEQUENCE AUTO/MANUAL switch to AUTO. Set SELF-TEST switch to LAMP TEST.	All lamps on test set are on except KEYLINE if control unit cable is not connected. If control unit is connected (with handset off-hook), all lamps are on. SEQUENCE STATE display indicates ".8.8". Note: ANI display dark.	Lamps operational. One or more lamps off.	Display/audio board malfunctioning.
3. Set SELF TEST switch to 2805/5V.	2805Hz lamp on	Tone encoder and tone decoder assemblies are operational at 2805Hz. 2805Hz lamp off.	Tone encoder (0400) or tone decoder (0300) inoperative.
	Meter indicates mid-scale. (green area)	Plus 5Vdc supply is operational and adjusted properly.	
		Meter indicates outside green area.	+5Vdc rectifier or regulator malfunctioning.

TABLE 2-2 (Cont'd)
SELF-TEST PROCEDURES

Operator Actions	Expected Results	Test Analysis and Error Indication	Source of Fault
4. Set SELF TEST switch to 1500/12V.	1500Hz lamp on.	Tone encoder and tone decoder are operational at 1500Hz.	
		1500Hz lamp off.	Tone encoder (0400) or tone decoder (0300) inoperative.
	Meter indicates mid-scale. (green area)	Plus 12Vdc supply is operational and adjusted properly.	
		Meter indicates outside green area.	+12Vdc power supply cable connections.
5. Set SELF TEST switch to DIALING. Set thumb-wheel ADDRESSING switch to any random numbers. Set CHANNEL SCAN TEST switch to OFF. Press SEQUENCE START.	SEQUENCE STATE display indicates "02".	Dialer and ANI display assemblies are operational.	
		Number other than "02" appears.	Check that SEQUENCE switch is set to AUTOMATIC. Check that the slide switch mount on the control board is in RUN position.
Press SEQUENCE START pushbutton once more.	ANI display copies thumb-wheel settings. Note: Eighth digit display only in SMART ANI.	ANI DISPLAY does not copy thumbwheel settings.	Check clock circuit on control board. Check dialer assembly or ANI DISPLAY on display audio board.
6. Press RESET button. Set SEQUENCE AUTO/MANUAL switch to MANUAL. Press TONES ON pushbutton once.	SEQUENCE STATE display indicates "02".		
		Number other than "02" appears.	Check that SEQUENCE switch is set to AUTOMATIC. Check that the slide switch mounted on the control board is in RUN position.

TABLE 2-2 (Cont'd)
SELF-TEST PROCEDURES

Operator Actions	Expected Results	Test Analysis and Error Indication	Source of Fault
Set ADDRESSING SEQUENTIAL/COMPLETE switch to COMPLETE as desired. Press ADDRESSING START pushbutton.	ANI DISPLAY copies thumbwheel settings.		
	SEQUENCE STATE indicates "23".	ANI display does not copy thumbwheel settings.	Check clock circuit on control board. Check Dialer Assembly or ANI DISPLAY on display audio board.
		Number other than "23" appears.	Control logic and/or Dialer PC board malfunctions.
7. Press SEQUENCE RESET pushbutton.	SEQUENCE STATE indicates "00".	Dialer assembly is operational.	
		If other than "00".	Dial assembly or ANI decoder.
8. Set POWER ON/OFF switch to OFF. Set SELF-TEST switch to OFF.			

RF-4950 CONTROL UNIT TEST SET

OPERATOR'S GUIDE

CHAPTER 3

CONTROL UNIT TESTS

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1. INTRODUCTION

1.01 The following test procedures will confirm proper operation or locate fault areas of the control units listed in chapter one of this manual. Detailed troubleshooting, repair and theory of operation of the various control units are contained in individual instruction manuals. Troubleshooting, repair and detailed theory of operations with block diagrams, schematics, sequence diagrams and parts lists for the test set are found in manual PM-1433. Table 3-1 shows test mode selection for the various control units.

TABLE 3-1
TEST MODE SELECTION

Control Unit Type	Mode				Scan Capability
	MTS	RCC-1500	RCC-2805	IMTS	
RF-495 (VP-1, VP-2)			X		
RF-495M (VP-1, VP-2)	X				
RF-494 A&B (VP-4)			X		
RF-4910			X	X	X
RF-4911	X			X	X
RF-4912				X	X
RF-4940	X	X		X	X

1.02 The test procedure for the RF-4911 control unit has been selected as the initial procedure to be described in this manual. The RF-4911 test covers the most complete range of test set capabilities; the remaining tests are shown as changes in, or deviations from, the RF-4911 tests with expected results. The operation of the RF-4940 is more complex than the other control units and is covered completely in table 3-8.

2. RF-4911 TEST PROCEDURE

2.01 After completing the self-test procedures in table 2-2, connect the test set to the control unit per figure 2-2 depending on test locations and requirements. With power applied and the control unit hand-set "on-hook", follow the test procedure in table 3-2 below.

Note: The interconnecting cable 6616-0030 with P2 going to J2 must never be forced. It is a zero pressure connector secured by turning a thumb lock.

TABLE 3-2

RF-4911 TEST PROCEDURE

Operator Actions	Expected Test Results	Invalid Test Results	Error Indicated/ Unit Malfunction
I. TEST SET PRELIMINARY SETTINGS			
1. SELF TEST switch "OFF".			
2. SCAN TEST "OFF".			
3. MODE "IMTS"			
4. SEQUENCE "AUTOMATIC"			
5. Set level to head			
a. Press SEQUENCE START pushbutton.	State 02 appears in the sequence state window.		
b. Audio "BASE STATION AUDIO OUT".	2000Hz tone emitted from speaker.		
c. Adjust Audio volume. (Set the OUTPUT LEVEL control to produce 0.7 Vrms with the control knob pulled out (on the 0-2.0 scale)	Output level to control unit is indicated on the meter.		
6. Press Sequence reset pushbutton.	State 00 appears in the sequence state window.		
7. Keyswitch "ON".			

TABLE 3-2 (Cont'd)
RF-4911 TEST PROCEDURE

Operator Actions	Expected Test Results	Invalid Test Results	Error Indicated/ Unit Malfunction
II. CONTROL UNIT PRELIMINARY SETTINGS			
1. Keyswitch "ON"	Front panel logo lamp turns on; control unit has power.	The control unit does not appear to be turned on.	a. Control unit lock switch. b. Check F3 on test set. If open, replace and try again. c. Keyswitch toggle not "ON". d. Fusible link open in control unit switchboard e. Faulty connector on cable.
2. Select AUTOMATIC SEQUENCE.			
3. Handset "on-hook".			
III. CHANNEL SELECT TEST			
1. Select the first channel switch only.	Channel 1 light flashes	Channel 1 does not flash. Other indicator lights turn on.	a. Scanning circuit on the switch PC board defective. b. Channel 1 pushbutton switch mechanically or electrically bad. c. S1 and S2 pin contacts.
2. Repeat step 1 for all remaining channels, selecting only one at a time.	The selected channel flashes.		
IV. CHANNEL SCAN TEST			
1. CHANNEL SCAN TEST on.	All the selected channel lamps are scanned, but not necessarily in order. The test set steps through states 03 and 05, then stops in state 02.	No scan. Non-selected channel lamps turn on. If test stops in state 03, then channel 1 is not being scanned.	Switch PC board in control unit is defective. Check channel selection switches and repeat test by pressing SEQUENCE RESET pushbutton and returning to step IV-1.
2. Select any number or combination of channels to include channel 1.			
3. Press SEQUENCE START pushbutton.			

TABLE 3-2 (Cont'd)
RF-4911 TEST PROCEDURE

Operator Actions	Expected Test Results	Invalid Test Results	Error Indicated/ Unit Malfunction
IV. CHANNEL SCAN TEST (Cont'd)			
		If test set stops in state 06 the control unit did not stop on the idle channel.	a. Phase lock loop tone detectors on the logic board in the control unit are insensitive or off frequency. (The test set may be used to determine the PLL tone detector sensitivity by adjusting the OUTPUT LEVEL control and noting where the test set stops scanning. b. Test set audio output level misadjusted. Repeat step 1.
V. MOBILE-TO-BASE SEQUENCE TEST AUTOMATIC MODE			
1. Set AUDIO switch to "CONTROL HEAD AUDIO OUTPUT".		<p>Note: The problems indicated below must be corrected before further tests may be made.</p> No signaling heard from the control unit.	
2. Remove handset from cradle (off-hook).	Two-tone signaling is from the control unit heard from the speaker and reads a minimum of 1Vrms on the voltmeter.		a. Oscillator board or logic board bad. b. Bad connections between PC boards in the control unit. c. Bad hook switches (N.C. contact may open). d. Bad connector on control unit.
	2150Hz and 1633Hz tone lamps on and flashing.	Some tones heard in speaker but lamps do not light or flash.	a. Tone from control unit not within frequency specifications. b. Low levels into test set (less than 1Vrms).
		Lamps flash intermittently.	a. Marginally off frequency. b. Low levels from control unit (less than 1Vrms).

TABLE 3-2 (Cont'd)
RF-4911 TEST PROCEDURE

Operator Actions	Expected Test Results	Invalid Test Results	Error Indicated/ Unit Malfunction
V. MOBILE-TO-BASE SEQUENCE TEST AUTOMATIC MODE (Cont'd)			
	The SEQUENCE STATE steps from state 02 thru 16, 47, 47, 57, and stops in state 60 at end of ANI.	Test set stops in state 16. 2150Hz and 1633Hz lamps continue flashing.	a. Indicates length of guard tone before connect tone burst is too long. b. Connect tone burst is absent or too short.
	The KEYLINE lamp turns on indicating the transmitter is keyed.	2150Hz lamp flashes once. Test set stops in state 53. Test set stops in state 50.	Indicates no connect tone generated. Indicates the guard tone before the connect tone burst is too short. Connect tone burst is too long.
	Note: To recover from these errors, press SEQUENCE START push-button.	Test set stops in state 52.	Connect tone burst too short.
		Test set stops in state 51.	No guard tone after connect burst.
		Test set stops in state 55. Guard tone may stay on.	No ANI or ANI started late.
		Test set stops in state 62.	ANI started too soon.
		Test set remains in state 57. ANI keeps running.	a. Defective logic board. b. Broken programming jumper.
	The decimal points on the ANI display are not illuminated.	Decimal points on the ANI display are illuminated.	Parity error sent in ANI signaling.
	The number programmed into the control unit is displayed on the "ANI display" readouts.	Wrong number displayed.	Different number programmed in the control unit than anticipated.
	An 1800Hz (seize) tone is heard in the handset ear-piece when test set is in state 60.	No tone heard in handset when test set in state 60.	Audio gate in control unit malfunction.



TABLE 3-2 (Cont'd)
RF-4911 TEST PROCEDURE

Operator Actions	Expected Test Results	Invalid Test Results	Error Indicated/ Unit Malfunction
V. MOBILE-TO-BASE SEQUENCE TEST AUTOMATIC MODE (Cont'd)			
3. Dial any number.	Note that the 2150Hz and 1633Hz lamps are indicating signaling. Note: By slowing the dial return, the number of 1633 Hz flashes may be counted to make sure they agree with the digit dialed.	One or no tone lamps turn on. Guard tone 2150Hz stays on.	Defective dial assembly or logic board.
	The test set steps to sequence state 40.	Sequence state 60 still indicated.	a. No 1633Hz detected by the test set. Check that tone is coming from the control unit. b. Defective logic board.
4. Ensure that the AUDIO switch is in the "CONTROL HEAD AUDIO OUTPUT" position.			
5. Whistle into the control unit through handset.	Note that a level of at least 1Vrms is reached when whistling into the handset.	No level is indicated on the meter. Low level indicated on meter. Impossible to obtain 1Vrms regardless of audio level into the microphone.	a. Bad connections, bad microphone element or broken wires on handset. b. Defective audio gate on logic board. Defective microphone element or logic board.

VI. DISCONNECT SEQUENCE

1. Note that the test set is in state 40.			
2. Place control unit handset on-hook.	The SEQUENCE STATE steps through state 45 and stops in state 00.	The test set stops in state 42.	No 2150Hz pulses in disconnect burst. Defective logic board or oscillator board.

TABLE 3-2 (Cont'd)
RF-4911 TEST PROCEDURE

Operator Actions	Expected Test Results	Invalid Test Results	Error Indicated/ Unit Malfunction
VI. DISCONNECT SEQUENCE (Cont'd)			
		The test set stops in state 46.	The individual 2150Hz or 1336Hz tone bursts are too short. Defective logic board.
		The test set stops in state 45.	a. complete disconnect burst is too short. b. logic board defective.
VII. BASE-TO-MOBILE SEQUENCE-AUTOMATIC MODE			
1. If desired, perform section IV channel scan test, then proceed as follows:			
a. CHANNEL SCAN TEST "OFF".			
b. Press SEQUENCE START pushbutton.	Note test set stops in sequence state 02. Scan may stop in any selected channel.	Scan does not stop. Test set is in state 02.	Set AUDIO switch to: a. "BASE STATION AUDIO OUTPUT" and confirm proper setting of audio level. b. Check that SEQUENCE switch is set to AUTOMATIC.
2. Set the addressing thumbwheel switches to the known number programmed in the control unit or the number that was displayed in the ANI display readout in section V-2.	Note: If a number of less than seven digits is programmed, set blanks to the left and the programmed number to the right on the thumbwheel switches.		
3. Press SEQUENCE START pushbutton.	The test set steps through states 20 and 26 as it is signaling to the unit.		
Note: At this time the control unit is being called.			
Note: Control unit must be "on-hook" to do this test.	The test set steps to state 32 then to the ring cycle (34, 36) and to state 33.	Test set stops in state 23. 2150Hz tone on scan does not resume.	Acknowledge not started in time. Logic board.



TABLE 3-2 (Cont'd)
RF-4911 TEST PROCEDURE

Operator Actions	Expected Test Results	Invalid Test Results	Error Indicated/ Unit Malfunction
VII. BASE-TO-MOBILE SEQUENCE-AUTOMATIC MODE (Cont'd)			
		Test set stops in state 32.	Acknowledge tone burst too long. Logic board.
		Test set stops in state 37.	Acknowledge tone burst too short. Logic board.
	An audible ring signal is heard in the control unit earpiece. States 34 and 36.	No ring heard, scan resumes state 23.	Control unit rejected number dialed.
			a. Unit malfunction. b. Wrong number dialed. c. Level control not adjusted properly.
		No ring heard, scan does not resume.	a. Audible alarm "ring" circuit malfunction on dial board. b. Defective earpiece. c. Broken cable to handset. d. Defective hook switches. e. Defective 750msec timer on logic board.
4. Depress the HORN button on the control unit.	The ALARM lamp illuminates in unison with the ring.	The ALARM light does not illuminate.	a. Horn relay or drive circuitry malfunction on logic board. b. Bad connection in control unit connector.
5. Return the horn button to the "off" (out) position.	The ALARM light does not illuminate.	The ALARM does illuminate.	Defective switch board.
6. Remove the handset from the cradle (off-hook).	The test set steps to state 40. Note 1633Hz burst.	Test set stops in state 35.	Answer tone burst too long.
		Test set stops in state 41.	Answer tone burst too short.

TABLE 3-2 (Cont'd)
RF-4911 TEST PROCEDURE

Operator Actions	Expected Test Results	Invalid Test Results	Error Indicated/ Unit Malfunction
VII. MOBILE-TO-BASE SEQUENCE TEST AUTOMATIC MODE (Cont'd)			
	Note: This is the normal connect state, i.e., the mobile is connected to the phone line.	Test set continues in ring mode.	Off-hook (1633Hz) recognized. Hook switches.
	The KEYLINE LAMP turns on.	The KEYLINE lamp remains off.	a. logic board in control unit is defective. b. Bad connection of P2 between logic board and switch board.
7. Repeat steps V-4 and V-5.			
8. Depress the PARTY button on the control unit.	The KEYLINE lamp turns off.	The KEYLINE lamp remains on.	Defective switch board or logic board in control unit.
9. Depress the push-to-talk switch on the control unit handset.	The KEYLINE lamp turns on for the period of time the push-to-talk switch is depressed.	The KEYLINE Lamp remains off.	a. Handset is defective. b. Loose or broken wire to handset. c. Switch board is defective. d. Logic board is defective.
10. Repeat section VI and this completes the test of the automatic mode of the control unit.			



TABLE 3-2 (Cont'd)

RF-4911 TEST PROCEDURE

Operator Actions	Expected Test Results	Invalid Test Results	Error Indicated/ Unit Malfunction
VIII. MANUAL MODE—MOBILE-TO-BASE SEQUENCE			
1. Manual mode test set Preliminary set-up.			
a. MODE "MTS"			
b. SEQUENCE "AUTO-MATIC"			
c. CHANNEL SCAN TEST "ON"			
d. SELF-TEST Switch "OFF"			
e. Set-up Levels:			
1. Press SEQUENCE START pushbutton	State 02 appears in the SE- QUENCE STATE window.		
2. AUDIO - "BASE STATION AUDIO OUTPUT"			
3. AUDIO VOLUME as required.			
4. OUTPUT LEVEL - set to 2Vrms or maximum whichever occurs first.			
2. Press SEQUENCE RE-SET pushbutton.	State 00 appears in the SE- QUENCE window.		
3. Keyswitch "ON".			

IX. CONTROL UNIT PRELIMINARY SETTINGS

1. Manual button "IN"
2. Horn Button "IN"
3. Channel Select Buttons "OUT"
4. Handset in the cradle (on-hook)

TABLE 3-2 (Cont'd)
RF-4911 TEST PROCEDURE

Operator Actions	Expected Test Results	Invalid Test Results	Error Indicated/ Unit Malfunction
X. CHANNEL SELECTION TEST			
1. Select the first channel button only.	Note that channel 1 lamp turns on.	Wrong channel lamp turns on.	Defective switch board in control unit.
2. Repeat the above selecting only one channel at a time.	Note that the corresponding channel lamp turns on.	No channel lamp turns on. Channel lamp partly on. More than one channel lamp turns on at the same time.	
XI. CHANNEL SCAN TEST			
1. Ensure that no channel is selected (all buttons out).	Note that the control head scans all channels. Note: Handset must be on-hook for scanning to occur.		
2. CHANNEL SCAN TEST "ON".			
3. Press SEQUENCE START pushbutton.	The test set steps through state 03 and stops in state 02.	The test set stops in state 03. The test set stops in state 06. Note: To recover from this error, press the SEQUENCE START button and the test set will step to state 02.	Channel 1 is not being scanned. The control unit did not lock on channel 1 in the specified time interval. The output level is not adjusted properly. Tone detector malfunction in control unit. Logic board malfunction in control unit.

TABLE 3-2 (Cont'd)
RF-4911 TEST PROCEDURE

Operator Actions	Expected Test Results	Invalid Test Results	Error Indicated/ Unit Malfunction
XII. BASE-TO-MOBILE CALL SEQUENCE			
1. ADDRESSING thumb-wheel switch set to the number programmed into the control unit.			
2. Audio switch to control head audio output.	The test set steps through various states as it is dialing the control unit.		
3. Press SEQUENCE START pushbutton.	A three-second ring interval is provided after signaling.	The control unit does not ring.	Improper number set on thumbwheel switch. Audio output level of the test set not adjusted properly. Audio output level of the test set not adjusted properly. Control unit did not recognize signaling. Bad logic board.
	The ring is turned off after three seconds.	The ring is not turned off.	Control unit malfunction - logic board.
	Test set stops in state 00.		
	Alarm lamp on during ring.		
4. Remove handset from cradle and return to cradle.	Busy lamp turns off.		

TABLE 3-2 (Cont'd)

RF-4911 TEST PROCEDURE

Operator Actions	Expected Test Results	Invalid Test Results	Error Indicated/ Unit Malfunction
XIII. MOBILE-TO-BASE SEQUENCE			
1. Remove handset from cradle (come off-hook).	If no channel buttons were depressed, scanning stops.		
2. Depress the PTT switch.	The KEYLINE lamp turns on.	The KEYLINE lamp remains off.	a. Defective handset PTT switch. b. Defective logic board.
3. Speak or whistle into the microphone, with PTT still depressed.	Peaks of at least 1Vrms are seen on the meter with the AUDIO switch set to "CONTROL HEAD AUDIO OUTPUT".	No level is indicated on meter.	a. Bad connections, bad microphone element or broken wires in handset. b. Defective audio gate on logic board.
		Low level indicated on meter. Impossible to obtain 1Vrms regardless of audio level into the microphone.	Defective microphone element or logic board.

3. RF-4910 TEST PROCEDURE

3.01 Follow the procedure in table 3-2 as modified by the changes listed in table 3-3.

TABLE 3-3

RF-4910 TEST PROCEDURE

Table 3-2 Section/Paragraph	Changes For RF-4910 Tests
Sections I through VII	None
Section VIII/1a. 1c.	MODE "RCC/2805" CHANNEL SCAN TEST "OFF"
Sections IX through XIII	None

4. RF-4912 TEST PROCEDURE

4.01 Follow the procedure in table 3-2 as modified by the changes listed in table 3-4.

TABLE 3-4

RF-4912 TEST PROCEDURE

Table 3-2 Section/Paragraph	Changes For RF-4912 Tests
Section I	None
Section II	Delete paragraph 2.
Section III	Delete section.
Section IV	Delete paragraph 2.
Sections V & VI	None
Section VII	Delete paragraphs 8 and 9.
Sections VIII through XIII	Delete sections.

5. RF-494 A & B (VP-4) TEST PROCEDURES

5.01 The test procedure in table 3-5 is presented for the **RF-494A** control unit, a VP-4 with ANI. With the ANI option, a thumbwheel switch with positions 0 through 9 is included and is mounted on the front panel. The **RF-494B** unit does not have the ANI option but may have a dial encoder that allows the mobile to originate outgoing calls. The dial encoder is contained in the ANI board for outbound dialing in the **494A** control unit.

5.02 The test for ANI, as presented in table 3-5, is set to close specifications for tolerances of frequency and timing. It should be noted that the ANI signal from a mobile radiotelephone may have incorrect frequency, timing, or framewords. While this ANI signal may be acceptable to some terminals, the test set will reject the signal because it is outside the prescribed specification.

5.03 When a test is performed on a **494A**, the test operator will hear a low pitch tone in the handset receiver while off-hook, indicating that the control head audio path is opened. Also, when the PTT switch is initially depressed, and if the AUDIO switch is in the CONTROL HEAD AUDIO OUTPUT position, there will be a pause in the tone. An audio tone will then be heard on the test set speaker while the meter indicates the amplitude of the ANI signal. The display will remain blank or indicate a wrong number calling attention to a probable error.

5.04 The test procedure in table 3-6 is presented for the **RF-494B** control unit, a VP-4 without ANI. The test procedure assumes the presence of a plug-in dial encoder.

TABLE 3-5
RF-494A (VP-4) TEST PROCEDURE

Operator Actions	Expected Test Results	Invalid Test Results	Error Indication Unit Malfunction
I. TEST SET PRELIMINARY SETTINGS			
1. CHANNEL SCAN TEST			
2. MODE "RCC/2805"			
3. SEQUENCE "AUTO- MATIC"			
4. KEYSWITCH "ON".			
5. Set level to head			
a. Press SEQUENCE START pushbutton.	State 02 appears in the se- quence state window. 2805		
b. AUDIO switch to "BASE STATION AUDIO OUTPUT".	Hz tone emitted from speaker.		
c. Adjust audio volume. (Adjust the output level to produce 0.1 Vrms with the level control knob pulled out (0-2.0 scale).	The output level of audio to the control unit is indicated on the meter.		
6. Press SEQUENCE RE- SET pushbutton.	State 00 appears in the se- quence state window.		

II. CONTROL UNIT PRELIMINARY SETTINGS

1. Keyswitch "ON".	Front panel lamp is on; con- trol unit has power.	The control unit does not appear to be turned on.	a. Control unit lock- switch. b. Keyswitch toggle not on. c. Check F3 on the test set. If open, replace and try again. d. Faulty connector on cable.
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Note: The KEYSWITCH on the test set overrides the ignition switch on the control unit. Keyswitch on the control unit must be on for the unit to have power.

2. Check that handset is
"on-hook".

TABLE 3-5 (Cont'd)

RF-494A (VP-4) TEST PROCEDURE

Operator Actions	Expected Test Results	Invalid Test Results	Error Indication Unit Malfunction
III. CHANNEL SELECT TEST			
1. Select the first channel switch only.	Channel 1 lamp is on.	Channel 1 lamp does not turn on. Other lamps are on.	a. Channel 1 pushbutton switch electrically or mechanically bad. b. Select switch pin contacts.
2. Repeat step 1 for all remaining channels. Note that channel 1 returns to the off position when channel 2 is selected, etc.	The selected channel lamp is on.		
<p>Note: With the channel revert feature with all select buttons out, the control unit automatically returns to pre-selected "home" channel. Home channel is factory-wired to the far left channel. See VP-4 instruction manual.</p>			
IV. BASE-TO-MOBILE SEQUENCE TEST			
1. Set thumbwheel switches on test set to agree with programmed number in the control unit. See VP-4 manual to determine number if not known.			
2. Press SEQUENCE START pushbutton.	State 02 is in the SEQUENCE STATE window.		
3. Set AUDIO switch to "BASE STATION AUDIO OUTPUT".	2805Hz tone emitted from speaker with 0.1Vrms on the meter.		
4. Set AUDIO switch to "CONTROL HEAD AUDIO OUTPUT".	Low frequency hum emitted from speaker with 1.0Vrms minimum on meter.	No output from control unit.	ANI encoder board.
5. Horn button on control unit in.			

TABLE 3-5 (Cont'd)

RF-494A (VP-4) TEST PROCEDURE

Operator Actions	Expected Test Results	Invalid Test Results	Error Indication Unit Malfunction
IV. BASE-TO-MOBILE SEQUENCE TEST (Cont'd)			
6. Press SEQUENCE START pushbutton once more.	2805Hz tone on and off or low frequency hum, as con- trol unit is being dialed. AUDIO switch in BASE STATION or CONTROL HEAD position respec- tively. SEQUENCE STATE dis- play alternates between 20 and 26. At completion of dial se- quence, the yellow call lamp on the control unit flashes.	Call lamp remains off.	Control unit rejected num- ber dialed. a. Decoder Board. b. Wrong number dialed. c. Audio input level not adjusted properly.
	Ring signal is heard for approximately four se- conds.	Ring is not heard. Sequence state to 22 then to 00.	a. Level of audio input not adjusted properly. b. Ring circuit malfunction on decoder-memory board.
	HORN RELAY lamp on the test set illuminates for the period of time ring is on. SEQUENCE STATE at 22 at start of ring, returns to 00 during ring; meter re- turns to zero during ring.	Horn relay lamp remains off.	Horn relay circuitry.
7. Hand-set "off-hook".	Yellow call lamp turns off. Sequence state at 00. Meter goes to 1.0Vrms when AUDIO switch in CON- TROL HEAD position.	Lamp remains on.	Hook switch defective.

TABLE 3-5 (Cont'd)

RF-494A (VP-4) TEST PROCEDURE

Operator Actions	Expected Test Results	Invalid Test Results	Error Indication Unit Malfunction
IV. BASE-TO-MOBILE SEQUENCE TEST (Cont'd)			
8. Press PTT switch on hand-set.	Green transmit lamp on control unit and KEYLINE lamp on test set turn on. After delay of approximately 1 second, meter goes to zero.	Lamp remains off.	a. Decoder-memory board defective. b. PTT switch defective. c. Cable to hand-set defective.
9. Release PTT switch.	Green transmit lamp turns off.	Lamp remains on.	a. PTT switch defective. b. Duplex pushbutton is in. c. Latch circuit on Decoder-memory board.
10. Duplex button on control unit in.			
11. Push, hold and then release PTT switch on handset.	Green transmit lamp turns on and remains on when PTT is released. KEYLINE lamp on test set on.	Lamp does not remain on.	a. Duplex button defective. b. Latch circuit on decoder-memory board.
12. Speak or whistle into handset microphone.	Audio level of at least 1.0 Vrms on meter when audio switch is in CONTROL HEAD AUDIO OUTPUT position.	No level indicated on meter.	a. Bad connections, bad microphone element. b. Defective audio circuit on decoder-memory board.
13. Replace hand-set "on-hook".	Green transmit light goes out.		a. Defective microphone element. b. Audio circuitry on decoder-memory board.

V. BASE-TO-MOBILE STANDBY TEST

1. With handset "on-hook", SEQUENCE state 00 and thumbwheel switches set to correct control unit number, press the standby button.	Front panel lamp turns on.		
2. Turn KEYSWITCH on control unit to "OFF".	Front panel lamp remains on.	Front panel lamp turns off.	Defective standby switch.

TABLE 3-5 (Cont'd)
RF-494A (VP-4) TEST PROCEDURE

Operator Actions	Expected Test Results	Invalid Test Results	Error Indication Unit Malfunction
V. BASE-TO-MOBILE STANDBY TEST (Cont'd)			
3. Press SEQUENCE START button twice to start dialing.	Sequence State steps to 02 then to 20-26 as unit is dialed. Unit rings for approximately 4 seconds (meter shows approximately 1.0 Vrms). HORN RELAY lamp on the test set illuminates. Call lamp flashes.		
4. Handset "off-hook".	Yellow call lamp turns off.		
5. Press PTT switch.	Yellow call lamp and green transmit lamp remains off. KEYLINE lamp on test set is off.	Transmit lamp turns on.	Keyswitch defective or not "OFF".
6. Return handset to cradle, release standby switch and turn keyswitch "ON".			

VI. MOBILE-TO-BASE SEQUENCE

1. Press SEQUENCE RESET pushbutton.	SEQUENCE STATE is 00.		
2. Handset "off-hook".	Meter shows 1.0Vrms min. with AUDIO switch in CONTROL HEAD AUDIO OUTPUT position.	No indication on meter, no audio in earpiece.	ANI encoder board defective.
3. Press PTT switch and Hold On.	Meter reads 0 volts and green transmit lamp turns on.	Transmit lamp is on. KEYLINE lamp is off.	a. PTT switch defective. b. Decoder-memory board defective. c. Cable to handset defective. d. Lamp or diode defective on panel.

TABLE 3-5 (Cont'd)
RF-494A (VP-4) TEST PROCEDURE

Operator Actions	Expected Test Results	Invalid Test Results	Error Indication Unit Malfunction
VI. MOBILE-TO-BASE SEQUENCE			
4. Speak or whistle into hand-set microphone.	Meter reads at least 1.0Vrms with AUDIO switch in CONTROL HEAD AUDIO OUTPUT position.	No level indicated on meter.	a. Bad connections, bad microphone element or broken wires on handset. b. Defective audio circuit on decoder-memory board.
		Low level indicated on meter, impossible to obtain 1.0Vrms.	a. Defective microphone element. b. Audio circuit on decoder-memory board.
5. Dial a random number.	At the start of dialing a 2805Hz tone is heard in the hand-set earpiece and the test set speaker.	No 2805Hz tone heard.	Dial encoder section of the ANI encoder PC board.
	The 2805Hz lamp on the test set turns on and flashes in relation to the digit dialed.	Lamp remains off.	If a low frequency tone was present in initial part of test VI, the ANI encoder is operational but the frequency (2805Hz) is out of tolerance.
	The correct digit has been produced by the control unit, determined by counting the number of times the 2805Hz lamp turns off (or the tone turns off) as the dial is slowly returned to its stop.	Incorrect number produced.	a. Dial contacts. b. Dial encoder circuit on ANI PC board.

Note: The VP-4 unit with the ANI option may be tested for mobile-to-base operation in either RCC/2805 or SMART mode on the test set.

TABLE 3-5 (Cont'd)

RF-494A (VP-4) TEST PROCEDURE

Operator Actions	Expected Test Results	Invalid Test Results	Error Indication Unit Malfunction
VII. ANI SEQUENCE			
	Note: For VP-4 control units with ANI option only. (With a mounted thumbwheel switch on front panel of control unit).		
1. Press SEQUENCE RESET pushbutton. Handset in the cradle.	SEQUENCE STATE is 00.		
2. Mode switch to "SMART".			
3. Press SEQUENCE START pushbutton.	SEQUENCE STATE goes to 10.		
4. Handset "off-hook".	Meter indicates 1.0Vrms approximately with AUDIO switch in CONTROL HEAD AUDIO OUTPUT position.	No indication on meter.	ANI encoder board.
5. Thumbwheel switch on control unit set to any desired number.			
6. Press and hold the PTT switch.	SEQUENCE STATE goes to 15. Meter reads 0Vrms. Programmed number of control unit and eighth digit as set by thumbwheel switch displayed by test set ANI.	Eight digit number is not displayed on test set ANI.	ANI encoder board. See introduction to this test procedure.

TABLE 3-5 (Cont'd)

RF-494A (VP-4) TEST PROCEDURE

Operator Actions	Expected Test Results	Invalid Test Results	Error Indication Unit Malfunction
VIII. BUSY CIRCUIT TEST			
1. Press SEQUENCE RE- SET pushbutton.	SEQUENCE STATE is 00.		
2. Handset in the cradle.			
3. MODE switch to "RCC/ 2805".			
4. Press SEQUENCE START pushbutton.	SEQUENCE START is 02.		
5. Handset "off-hook".	A 2805Hz audio signal heard in handset earpiece. Switched at twice the ring rate.	No busy signal heard in handset earpiece.	Busy override strapping E to F. See control unit man- ual.

TABLE 3-6

RF-494B (VP-4) TEST PROCEDURE

I. TEST SET PRELIMINARY SETTINGS

1. CHANNEL SCAN
TEST "OFF".
2. MODE "RCC/2805".
3. SEQUENCE "AUTO-
MATIC"
4. KEYSWITCH "ON"
5. Set level to head -
 - a. Press SEQUENCE
START pushbutton. State 02 appears in the se-
quence state window.
 - b. Audio switch to
"BASE STATION
AUDIO OUTPUT". 2805Hz tone emitted from
speaker.
 - c. Adjust AUDIO VOL-
UME. Adjust the out-
put level to produce
0.1Vrms with the level
control knob pulled
out (0-2.0 scale). The output level of audio
to the control unit is indi-
cated on the meter.

TABLE 3-6

RF-494B (VP-4) TEST PROCEDURE

Operator Actions	Expected Test Results	Invalid Test Results	Error Indication Unit Malfunction
I. TEST SET PRELIMINARY SETTINGS (Cont'd)			
6. Press SEQUENCE RESET pushbutton.	State 00 appears in the se- quence state window.		
II. CONTROL UNIT PRELIMINARY SETTINGS			
1. Keyswitch "ON".	Front panel lamp is on; control unit has power.	The control unit does not appear to be turned on.	a. Control unit lockswitch. b. Keyswitch toggle not on. c. Check F3 on the test set. If open, replace and try again. d. Faulty connector on cable.
<p>Note: The KEYSWITCH on the test set overrides the ignition switch on the control unit. Keyswitch on the control unit must be on for the unit to have power.</p>			
2. Check that handset is "on-hook".			
III. CHANNEL SELECT TEST			
1. Select the first channel switch only.	Channel 1 lamp is on.	Channel 1 lamp does not turn on. Other lamps are on.	a. Channel 1 pushbutton switch electrically or mechanically bad. b. Select switch pin con- tacts.
2. Repeat step 1 for all re- maining channels. Note that channel 1 returns to the off position when channel 2 is selected, etc.	The selected channel lamp is on.		
<p>Note: With the channel revert feature and all select buttons out, the control unit automatically returns to preselected "home" channel. Home channel is factory-wired to the far left channel. See VP-4 instruction manual.</p>			

TABLE 3-6 (Cont'd)

RF-494B (VP-4) TEST PROCEDURE

Operator Actions	Expected Test Results	Invalid Test Results	Error Indication Unit Malfunction
IV. BASE-TO-MOBILE SEQUENCE TEST			
1. Set thumbwheel switches on test set to agree with programmed number in the control unit. See VP-4 manual to determine number if not known.			
2. Press SEQUENCE START pushbutton.	Sequence state is 02.		
3. AUDIO Switch set to "BASE STATION AUDIO OUTPUT".	2805Hz tone emitted from speaker with 0.1Vrms on the meter.		
4. Horn button on control unit in.			
5. Press SEQUENCE START pushbutton.	Switched 2805Hz tone heard as unit is being dialed.		
	SEQUENCE STATE alternates between 20 and 26.		
	At completion of dial sequence the yellow call lamp on the control unit flashes.	Call lamp remains off.	Control unit rejected number dialed. a. Decoder board. b. Wrong number dialed. c. Audio input level not adjusted properly.
	A ring signal is heard for approximately four seconds.	Ring is not heard.	a. Level of input audio not adjusted properly.
	The HORN RELAY lamps turns on for the duration of the ring. The SEQUENCE STATE at 22 at start of ring, returns to 00 during ring.	Relay lamp remains off.	b. Ring circuit malfunction on decoder-memory board. Horn relay circuitry.

TABLE 3-6 (Cont'd)
RF-494B (VP-4) TEST PROCEDURE

Operator Actions	Expected Test Results	Invalid Test Results	Error Indication Unit Malfunction
IV. BASE-TO-MOBILE SEQUENCE TEST (Cont'd)			
6. Handset "off-hook".	Yellow call lamp turns off.	Lamp remains on.	Hook switch defective.
7. Press PTT switch on hand-set.	SEQUENCE STATE at 00. Green transmit lamp on control unit turns on. KEYLINE lamp on test set turns on.	Lamp remains off. KEYLINE lamp remains off.	a. Decoder-memory board defective. b. PTT switch defective. c. Cable to handset defective.
8. Release PTT switch.	Green transmit light turns off.	Lamp remains on.	a. PTT switch defective. b. Duplex button is in. c. Latch circuit on decoder-memory board.
9. Duplex Button on control unit in.			
10. Press, hold and then release PTT switch on handset.	Green transmit lamp turns on and remains on when PTT released. KEYLINE lamp on test set turns on.	Lamp does not remain on.	a. Duplex button defective. b. Latch circuit on decoder-memory board.
11. Speak or whistle into hand-set microphone.	Audio level of at least 1.0 Vrms on meter when audio switch is in CONTROL HEAD AUDIO OUTPUT position.	No level indicated on meter.	a. Bad connections, bad microphone element or broken wires on handset.
12. Replace handset "on-hook".	Transmit lamp turns off.	Low level indicated on meter. Impossible to obtain 1.0Vrms.	a. Defective microphone element. b. Audio circuit on decoder-memory board.

TABLE 3-6 (Cont'd)

RF-494B (VP-4) TEST PROCEDURE

Operator Actions	Expected Test Results	Invalid Test Results	Error Indication Unit Malfunction
V. BASE-TO-MOBILE STANDBY SEQUENCE			
1. With handset "on-hook", SEQUENCE STATE 00 and thumbwheel switches set to correct control unit number, press the standby button.	Front panel lamp turns on.		
2. Turn KEYSWITCH on Control Unit to OFF.	Front panel lamp remains on.	Front panel lamp turns off.	Defective standby switch.
3. Press SEQUENCE START button twice to dialing.	SEQUENCE STATE steps to 20-26 as unit is dialed. Unit rings for approxi- mately four seconds. HORN RELAY lamp on the test set illuminates. Call lamp flashes.		
4. Handset "off-hook".	Yellow call lamp turns off.		
5. Press PTT switch.	Yellow call lamp and green transmit lamp remain off. KEYLINE lamp on test set is off.	Transmit lamp turns on.	Keyswitch defective or not "OFF".
6. Return handset to cradle, release standby switch and turn KEYSWITCH "ON".			

VI. MOBILE-TO-BASE SEQUENCE

1. Press SEQUENCE RE-
SET pushbutton. SEQUENCE STATE is 00.
2. Handset "off-hook".

TABLE 3-6 (Cont'd)

RF-494B (VP-4) TEST PROCEDURE

Operator Actions	Expected Test Results	Invalid Test Results	Error Indication Unit Malfunction
3. Press PTT switch and hold ON.	Green transmit lamp on. KEYLINE lamp on test set turns on.	Transmit lamp remains off. KEYLINE lamp remains off.	a. PTT switch defective. b. Decoder-memory board defective. c. Cable to handset defective. d. Lamp or diode on panel defective.
4. Speak or whistle into handset microphone.	Audio level of at least 1.0 Vrms on meter with AUDIO switch in CONTROL HEAD AUDIO OUTPUT position.	No level indicated on meter.	a. Bad connections, bad microphone element or broken wires on handset. b. Defective audio circuit on decoder-memory board.
5. Dial any number. Note: For units with dial encoder option.	At the start of dialing, a 2805Hz tone is initiated which is heard in the handset earpiece and from the test set speaker. The 2805Hz lamp on the test set flashes in relation to the digit dialed. The correct digit has been produced by the control unit, determined by counting the number of times the 2805Hz lamp turns off or the tone turns off as the dial is slowly returned to its stop.	Low level indicated on meter; impossible to obtain 1.0Vrms. No 2805Hz tone heard. Lamp does not illuminate Incorrect number produced.	a. Defective microphone element. b. Audio circuit on decoder-memory board. Dial encoder PC Board. If tone heard, frequency is out of tolerance. a. Dial contacts. b. Dial encoder plug-in board defective.

VII. BUSY CIRCUIT TEST

1. Press SEQUENCE RESET pushbutton.	SEQUENCE STATE is 00.		
2. Handset in the cradle.			
3. MODE switch to "RCC/2805".			
4. Press SEQUENCE START pushbutton.	SEQUENCE STATE is 02.		
5. Handset "off-hook".	A 2805Hz audio signal heard in handset earpiece. Switched at twice the ring rate.	No busy signal heard in handset earpiece.	Busy override strapping E to F. See control unit manual.

6. RF-495 AND RF-495M (VP-1 AND VP-2) TEST PROCEDURE

6.01 Follow the procedure as outlined in tables 3-5 and 3-6 modified by the procedure shown in table 3-7. The standard interconnecting cable may be used for both the VP-1 and VP-2 control units.

6.02 The RF-495 control units (Secode VP-1 & VP-2) may be factory set to operate either as an RCC/2805 or MTS unit. The difference may be externally noted by observing the channel select button designations. Numbers 1, 3, 5, . . . 13 refer to RCC/2805 operation and letters JJ, JK, YJ, . . . QY refer to MTS operation at 1500/600Hz. The RCC unit is RF-495 and the MTS unit is RF-495M.

6.03 Tests for RF-495 and RF-495M are directly related to the RF-494B (VP-4 without ANI) test, table 3-6, with the exceptions noted. This assumes that options for busy channel and duplex, dial encoder and channel revert are incorporated. The busy and duplex option and the channel revert option on VP-1 and VP-2 units are separate small boards mounted on the chassis. See the VP manuals for location. The dial encoder is also a separate board, but if the unit has a standard telephone dial on the front, the dial encoder option is included. The VP-1 and VP-2 could have a duplex button and a busy lamp, but these options are not necessarily included.

TABLE 3-7

RF-495 & RF-495M TEST PROCEDURE

Refer to test procedure for Control Unit RF-494B (Table 3-6).

Table 3-6 Section/Paragraph

Changes For RF-495 Tests

Sections I through III

None

Section IV/5

Call lamp does not flash but is continuously on during ring and until handset is off-hook.

Section V through VII

None

RF-494B Section/Paragraph

Changes To RF-495M Tests

Section I/2 (Table 3-5)

MODE-MTS

Section I/5b. (Table 3-5)

Tone - 600Hz

Sections II and III

None

Section IV/3
Section IV/5

Tone alternates between 600Hz and 1500Hz. SEQUENCE STATE from 02 to 07 to 61, dials on 21 and 25, state 30 during ring and then to 00. The ring continues for one full period (approximately 4 seconds) and the call lamp and HORN RELAY lamp remain on for this time, regardless of the handset coming off-hook.

Section V

None

Section VI/5

Replace 2805Hz with 600Hz, dial is alternate 600Hz and 1500Hz tones and lamps. Count of correct digit is number of times 1500Hz tone and/or lamp turns on.

Section VII

None

7. ALPHA 40 SERIES (RF-4940) TEST PROCEDURE

7.01 To test an ALPHA 40 Series (RF-4940) while installed in the vehicle, use the special inter-connect cable 6616-0032 and power cable 6616-0010 for dc or 6616-0020 for ac. Referring to figure 2-4, remove the cover on the logic unit. Disengage the 40-pin transmitter connector and plug the test set cable in its place. The other end of the test cable plugs into the RF-4950. The test procedure follows in table 3-8.

7.02 For bench testing, use cable 6616-0031 and connect the under dash power/horn relay/external alert cable as follows (see figure 2-3):

RF-4940		RF-4950
Red wire	to	Red clip lead
White wire	to	Black clip lead
Orange wire	to	Yellow clip lead

When checking the RF-4940 in the vehicle, these connections are not necessary.

TABLE 3-8

ALPHA 40 SERIES (RF-4940) CONTROL UNIT TEST PROCEDURE

Operator	Expected Test Results	Invalid Test Results	Error Indicated/ Unit Malfunction
I. TEST SET PRELIMINARY SETTINGS			
1. SELF TEST switch "OFF".			
2. SCAN TEST "OFF". KEYSWITCH "ON".			
3. MODE "IMTS".			
4. SEQUENCE "AUTO- MATIC".			
5. Set level to head -			
a. Press SEQUENCE START pushbutton.	State 02 appears in the se- quence state window.		
b. Audio "BASE STA- TION AUDIO OUT".	2000Hz tone emitted from speaker.		
c. Adjust audio volume. (Set the OUTPUT LEVEL control to produce half scale reading with the con- trol knob pulled out. (on the 0-20 scale).	Output level to control unit is indicated on the meter.		
6. Press SEQUENCE RE- SET pushbutton.	State 00 appears in the se- quence state window.		

TABLE 3-8 (Cont'd)

ALPHA 40 SERIES (RF-4940) CONTROL UNIT TEST PROCEDURE

Operator	Expected Test Results	Invalid Test Results	Error Indicated/ Unit Malfunction
II. CONTROL UNIT PRELIMINARY SETTINGS			
1. Off/Aux/On switch "ON".	"ACCESS" appears in display, keyboard is lit; control unit has power. If electronic lock is disabled, a scanning mode appears in the display.	<p>The control unit does not appear to be turned on.</p> <p>"C" shows in display. Keyboard operates on number keys.</p> <p>"FAIL" shows in display. Keyboard operates on number keys.</p> <p>"FAIL" flashes dimly in display. Keyboard is inoperative.</p>	<p>a. Open fuse in cradle.</p> <p>b. Check F3 on test set. If open, replace and try again.</p> <p>c. Faulty connector on cable.</p> <p>Cable disconnected between cradle and logic unit.</p> <p>a. Intermittent cable from cradle to logic unit.</p> <p>b. Improper operation of serial data drivers and receivers.</p> <p>c. Crystal in handset or logic unit not operating at correct frequency.</p> <p>a. Cable not supplying +12V to trunk-logic board.</p> <p>b. Keyswitch not turned on (Step I-3).</p> <p>c. Fuse in trunk-logic unit blown.</p>
2. Enter Access Code and depress SND if ACCESS is displayed.			
3. SEL AUT.			

TABLE 3-8 (Cont'd)

ALPHA 40 SERIES (RF-4940) CONTROL UNIT TEST PROCEDURE

Operator	Expected Test Results	Invalid Test Results	Error Indicated/ Unit Malfunction
III. CHANNEL SELECT TEST			
1. SEL A1	All channels programmed into the control unit are scanned.	All channels are not scanned, lights remain on, etc.	Logic unit fault.
2. SEL H	Home channels are scanned.	Correct home channels are not scanned.	Code plug defective or not programmed properly.
3. SEL A2	Keyboard programmed channels are scanned.	Keyboard selected channels are not scanned.	a. Logic unit fault. b. A2 channels not programmed correctly. c. Keyboard defective.
IV. CHANNEL SCAN TEST			
1. Channel Scan Test switch on.			
2. SEL A1	All channels programmed into the control unit are scanned.	Channel 1 is not scanned.	This test cannot be performed. Go to Test V.
3. Press SEQUENCE START pushbutton.	The test set steps through states 03 and 05, then stops in state 02.	If test set stops in state 06, the control unit did not stop on the idle channel.	a. Logic board tone decoder fault. b. Trunk logic fault. c. Test set audio output level misadjusted.
V. MOBILE-TO-BASE SEQUENCE TEST AUTOMATIC MODE			
1. Set audio switch to "CONTROL HEAD AUDIO OUTPUT".			
2. Enter a number into the display.		Note: The problems indicated below must be corrected before further tests may be made.	

TABLE 3-8 (Cont'd)

ALPHA 40 SERIES (RF-4940) CONTROL UNIT TEST PROCEDURE

Operator	Expected Test Results	Invalid Test Results	Error Indicated/ Unit Malfunction
V. MOBILE-TO-BASE SEQUENCE TEST AUTOMATIC MODE (Cont'd)			
3. Remove handset from cradle (off-hook).	Two-tone signaling is from the control unit (heard from speaker) and reads a minimum of 1Vrms on the voltmeter.	No signaling heard from the control unit.	a. Logic board fault.
			b. Bad cable connection between logic board and test set.
			c. Bad hookswitch.
			d. Bad connector on control unit.
	2150Hz and 1633Hz tone lamps on and flashing.	Some tones heard in speaker but lamps do not light or flash.	a. Tone from control unit not within frequency specifications.
			b. Low levels into test set (less than 1Vrms).
		Lamps flash intermittently.	a. Marginally off frequency.
			b. Low levels from control unit (less than 1Vrms).
	The SEQUENCE STATE steps from state 02 thru 16, 47, 57, and stops in state 60 at end of ANI.	Test set stops in state 16.	a. Indicates length of guard tone before connect tone burst is too long.
		2150Hz and 1633Hz lamps continue flashing.	b. Connect tone burst is absent or too short.
		2150Hz lamp flashes once.	Indicates no connect tone generated.
		Test set stops in state 53.	Indicates the guard tone before the connect tone burst is too short.
	The KEYLINE lamp turns on indicating the transmitter is keyed.	Test set stops in state 50.	Connect tone burst is too long.

TABLE 3-8 (Cont'd)

ALPHA 40 SERIES (RF-4940) CONTROL UNIT TEST PROCEDURE

Operator	Expected Test Results	Invalid Test Results	Error Indicated Unit Malfunction
V. MOBILE-TO-BASE SEQUENCE TEST AUTOMATIC MODE (Cont'd)			
	Note: To recover from these errors, press SEQUENCE START pushbutton.	Test set stops in state 52.	Connect tone burst too short.
		Test set stops in state 51.	No guard tone after connect burst.
		Test set stops in state 55. Guard tone may stay on.	No ANI or ANI started late.
		Test set stops in state 62.	ANI started too soon.
		Test set remains in state 57. ANI keeps running.	Defective logic unit.
	The decimal points on the ANI display are not illuminated.	Decimal points on the ANI display are illuminated.	Parity error sent in ANI signaling.
	The number programmed into the control unit is displayed on the "ANI display" readouts.	Wrong number displayed.	Different number programmed in the code plug than anticipated.
	An 1800Hz (seize) tone is heard in the handset earpiece when test set is in state 60.	No tone heard in handset when test set in state 60.	Audio gate in control unit malfunction.
4. Depress SND.	Note that the 2150Hz and 1633Hz lamps are indicating signaling.	One or no tone lamps turn on. Guard tone 2150Hz stays on.	Defective logic unit.
	The test set steps to sequence state 40.	Sequence state 60 still indicated.	a. No 1633Hz detected by the test set. Check that tone is coming from the control unit. b. Defective logic unit.

TABLE 3-8 (Cont'd)

ALPHA 40 SERIES (RF-4940) CONTROL UNIT TEST PROCEDURE

Operator	Expected Test Results	Invalid Test Results	Error Indicated/ Unit Malfunction
V. MOBILE-TO-BASE SEQUENCE TEST AUTOMATIC MODE (Cont'd)			
5. Ensure that the AUDIO switch is in the "CONTROL HEAD AUDIO OUTPUT" position.			
6. Whistle into the control unit thru handset.	Note that a level of at least 1Vrms is reached when whistling into the handset.	No level is indicated on the meter.	a. Bad connections, bad microphone element, defective cable.
			b. Defective audio gate on logic unit.
		Low level indicated on meter. Impossible to obtain 1Vrms regardless of audio level into the microphone.	Defective handset or logic unit.

VI. DISCONNECT SEQUENCE

1. Note that the test set is in state 40.			
2. Place control unit handset on-hook or SEL END.	The SEQUENCE STATE steps through state 45 and stops in state 00.	The test set stops in state 42.	No 2150Hz pulses in disconnect burst. Defective logic board or oscillator board.
		The test set stops in state 46.	The individual 2150Hz or 1336Hz tone bursts are too short. Defective logic board.
		The test set stops in state 45.	a. Complete disconnect burst is too short.
			b. Logic board defective.

TABLE 3-8 (Cont'd)

ALPHA 40 SERIES (RF-4940) CONTROL UNIT TEST PROCEDURE

Operator	Expected Test Results	Invalid Test Results	Error Indicated/ Unit Malfunction
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VII. BASE-TO-MOBILE SEQUENCE-AUTOMATIC MODE

1. If desired, perform section IV channel scan test, then proceed as follows:

- a. CHANNEL SCAN TEST "OFF".

- b. Press SEQUENCE START pushbutton.

Note test set stops in sequence state 02.

Scan may stop in any selected channel.

Scan does not stop. Test set is in state 02.

Set audio switch to:

- a. "BASE STATION AUDIO OUTPUT" and confirm proper setting of audio level.

- b. Check that SEQUENCE switch is set to AUTOMATIC.

2. Set the addressing thumbwheel switches to the known number programmed in the control unit or the number that was displayed in the ANI display readout in section V-2.

Note: If a number containing less than seven digits is programmed, set blanks to the left and the programmed number to the right on the thumbwheel switches.

3. Press SEQUENCE START pushbutton.

The test set steps through states 20 and 26 as it is signaling to the unit.

Note: At this time the control unit is being called.

TABLE 3-8

ALPHA 40 SERIES (RF-4940) CONTROL UNIT TEST PROCEDURE

Operator	Expected Test Results	Invalid Test Results	Error Indicated/ Unit Malfunction
VII. BASE-TO-MOBILE SEQUENCE-AUTOMATIC MODE (Cont'd)			
	The test set steps to state 32, then to the ring cycle (34, 36) and to state 33.	Test set steps in state 23. 2150Hz tone on. Scan does not resume.	Acknowledge not started in time. Logic unit.
		Test set stops in state 32.	Acknowledge tone burst too long. Logic unit.
		Test set stops in state 37.	Acknowledge tone burst too short. Logic tone.
	An audible ring signal is heard in the control unit earpiece. State 34 & 36.	No ring heard, scan resumes state 23.	Control unit rejected number dialed. a. Unit malfunction. b. Wrong number dialed. c. Level control not adjusted properly.
		Ring heard, scan does not resume, state 23.	Test set did not hear the acknowledge burst.
4. Carefully move the Off/Aux/On switch to the Aux position.	The ALARM lamp illuminates in unison with the ring, or extinguishes in unison with the ring.	The ALARM light does not illuminate, or stays illuminated.	a. Horn relay or drive circuitry malfunction on cradle board. b. Bad connection in control unit connector. c. Check jumpers 1 and 2 on cradle board.
5. Move the Off/Aux/On switch back to "ON".	The ALARM light does not illuminate.	The ALARM does illuminate.	Jumpers 1 and 2 on cradle board both in circuit.

TABLE 3-8 (Cont'd)

ALPHA 40 SERIES (RF-4940) CONTROL UNIT TEST PROCEDURE

Operator	Expected Test Results	Invalid Test Results	Error Indicated/ Unit Malfunction
VII. BASE-TO-MOBILE SEQUENCE-AUTOMATIC MODE (Cont'd)			
6. Remove the handset from the cradle (off-hook) or push SND if already off-hook.	The test set steps to state 40. Note 1633Hz burst.	Test set stops in state 35.	Answer tone burst too long.
		Test set stops in state 41.	Answer tone burst too short.
	Note: This is the normal connect state, i.e., the mobile is connected to the phone line.	Test set continues in ring mode.	Off-hook (1633Hz) recognized. Hook switch, logic unit fault.
	The KEYLINE lamp turns on.	The KEYLINE lamp remains off.	Logic unit is defective.
7. Repeat section V-4 and V-5.			
8. SEL PTY.	The KEYLINE lamp turns off.	The KEYLINE lamp remains on.	Defective logic unit or handset.
9. Depress the push-to-talk switch on the control unit handset.	The KEYLINE lamp turns on for the period of time the push-to-talk switch is depressed.	The KEYLINE lamp remains off.	a. Handset is defective. b. Loose or broken wire to handset. c. Logic unit is defective.
10. Repeat section VI and this completes the test of the automatic mode of the control unit.			

VIII. MANUAL MODE-MOBILE-TO-BASE SEQUENCE

1. Manual mode test set Preliminary set-up.
 - a. MODE "MTS" or "RCC-1500" or "RCC-2805".
 - b. SEQUENCE "AUTOMATIC".

TABLE 3-8 (Cont'd)

ALPHA 40 SERIES (RF-4940) CONTROL UNIT TEST PROCEDURE

Operator	Expected Test Results	Invalid Test Results	Error Indicated/ Unit Malfunction
VIII. MANUAL MODE-MOBILE-TO-BASE SEQUENCE			
c. CHANNEL SCAN TEST "OFF".			
d. SELF-TEST switch "OFF".			
e. Set-up Levels:			
1. Press SEQUENCE START push- button.	State 02 appears in the SE- QUENCE STATE window.		
2. AUDIO - "BASE STATION AU- DIO OUTPUT".			
3. AUDIO VOL- UME as required.			
4. OUTPUT LEVEL set to 2Vrms or maximum, which- ever occurs first.			
2. Press SEQUENCE RE- SET pushbutton.	State 00 appears in the SE- QUENCE window.		

IX. CONTROL UNIT PRELIMINARY SETTINGS

1. Sel MAN			
2. Off/Aux/On switch to Aux Position.			
3. Sel A1	All programmed channels are scanned.	All programmed channels are not scanned.	a. Defective code plug.
4. Handset in the cradle (on-hook).			b. Defective logic unit.

TABLE 3-8 (Cont'd)

ALPHA 40 SERIES (RF-4940) CONTROL UNIT TEST PROCEDURE

Operator	Expected Test Results	Invalid Test Results	Error Indicated/ Unit Malfunction
X. BASE-TO-MOBILE CALL SEQUENCE			
1. ADDRESSING thumb-wheel switch set to the number programmed into the control unit.			
2. Audio switch to control head audio output.	The test set steps through various states as it is dialing the control unit.		
3. Press SEQUENCE START pushbutton.	A three second ring interval is provided after signaling.	The control unit does not ring.	Improper number set on thumbwheel switch. Audio output level of the test set not adjusted properly. Control unit did not recognize signaling. Defective logic unit.
	The ring is turned off after three seconds.	The ring is not turned off.	Control unit malfunction - logic unit.
	The test set stops in state 00.		
	Alarm lamp on during ring.		
4. Remove hand-set from cradle and return to cradle, or SEL END.	Busy lamp turns off.		

TABLE 3-8 (Cont'd)

ALPHA 40 SERIES (RF-4940) CONTROL UNIT TEST PROCEDURE

Operator	Expected Test Results	Invalid Test Results	Error Indicated/ Unit Malfunction
XI. MOBILE-TO-BASE SEQUENCE			
1. Remove handset from cradle (come off-hook).	Scanning stops.		
2. Momentarily depress the PTT switch.	The KEYLINE lamp turns on and remains on.	The KEYLINE lamp remains off.	a. Defective handset PTT switch. b. Defective logic unit.
3. Speak or whistle into the microphone, with PTT still depressed.	Peaks of at least 1Vrms are seen on the meter with the AUDIO switch set to "CONTROL HEAD AUDIO OUTPUT".	No level is indicated on meter.	Bad connections, bad microphone element or broken wires in handset.
4. SEL PTY.	Keyline lamp turns off.	Keyline lamp remains on.	a. Defective logic unit. b. Defective audio gate on logic unit.
		Low level indicated on meter. Impossible to obtain 1Vrms regardless of audio level into the microphone.	Defective microphone element handset or logic unit.

RF-4950 CONTROL UNIT TEST SET

OPERATOR'S GUIDE

CHAPTER 4

MISCELLANEOUS

CONTENTS	PAGE
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2. FUNCTIONAL STATE TABLE	4-1
3. GLOSSARY OF TERMS	4-5
4. STATE SEQUENCE DIAGRAM	4-5

1. GENERAL

1.01 This chapter of manual PM-1422 provides additional information about the operation of the RF-4950 Control Unit Test Set. A function state table indicating the significance of a certain number in the SEQUENCE STATE window is presented. A logic state sequence diagram, glossary of terms, and timing chart are also included.

2. FUNCTIONAL STATE (TABLE 4-1)

STATE	FUNCTION	DESCRIPTION
-------	----------	-------------

00	Normal	Start sequence state - All test sequences start from this state. This state may be entered from any other state by pushing the SEQUENCE RESET switch.
01	Normal	Scan test sequence - Test sequence stops here until control unit is not on channel 1.
02	Normal	Standard test sequence state - From this state a land-to-mobile or mobile-to-land call may be initiated.
03	Normal	Scan test sequence - Test sequence stops here until control unit is on channel 1.
04	Normal	Scan test sequence - Typical delay for radio oscillator turn on.

1.02 Table 4-1, the functional state table, describes the function of each step in the TEST SEQUENCE. Each function is designated as a NORMAL or an ERROR function. A NORMAL function is typically one in which the test set performs in a manner independent of the control unit, whereas an ERROR function involves a response from the control unit under test.

1.03 The control logic state sequence diagram, figure 4-1, outlines the organization of the RF-4950 test set. At each step in the TEST SEQUENCE certain conditions must be met before the sequence can proceed to the next step. These conditions are shown in the diagram. The abbreviations used are defined in table 4-2, a glossary of terms. A more complete description of the control logic precedes the diagram.

FUNCTIONAL STATE TABLE (cont'd)

STATE	FUNCTION	DESCRIPTION
05	Normal	Scan test sequence - This state checks to see if control unit stops scanning when tone is turned on.
06	Error	Scan test error state - Control unit did not stop scan in proper time frame. Pushing SEQUENCE START switch in automatic mode or TONE ON switch in manual mode advances test sequence to state 02.
07	Normal	Transient state - Test set starts to dial a mobile.
10	Normal	Set-up state - Test sequence waits here for keyline to go low. Used in SMART ANI or non-IMTS scan check.
11	Normal	Transient state - Used in IMTS mobile-to-land calls in manual mode. Pushing TONES OFF switch causes this transfer from state 02.
12	Normal	Transient state - Used in non-IMTS mobile-to-land calls. From this state, test set always goes to state 00.
13	Normal	Scan check sequence - In non-IMTS mode, used to see if control unit stops in absence of tone. NOTE: This absence of tone scan check will be used for testing future control unit designs.
14	Normal	Scan check sequence - Test sequence waits until control unit is on channel 1.
15	Normal	Read state - Reads SMART ANI in this state.
16	Normal and Error	IMTS Automatic test sequence - Checks length of guard tone. Stops here if guard tone too long or no connect tone is generated after guard tone.
17	Normal	Scan test sequence - Delay for oscillator to turn off. Used in certain non-IMTS scan checks.
20	Normal	Dialing Test sequence - Used in non-IMTS dialing sequences.
21	Normal	Dialing test sequence - Used in MTS dialing sequence.
22	Normal	Dialing test sequence - Ring period for non-IMTS and MTS signaling sequences.

FUNCTIONAL STATE TABLE (cont'd)

STATE	FUNCTION	DESCRIPTION
23	Error	Dialing test sequence - Test sequence stops here if acknowledge did not start soon enough or did not come at all. Push SEQUENCE START switch recover. NOTE: Not error in self-test procedure.
24	Normal	Dialing test sequence - Used in MTS dialing sequence.
25	Normal	Dialing test sequence - Used in MTS dialing sequence.
26	Normal	Dialing test sequence - Used in all dialing sequences.
27	Normal	Dialing test sequence - Tone transition to stop MTS ring.
30	Normal	Dialing test sequence - Tone transition to stop MTS ring.
31	Normal	Dialing test sequence - Transition state after completion of non-IMTS land-to-mobile sequence.
32	Error	Ring test sequence - Used in IMTS mode while making land-to-mobile calls. Stops here if acknowledge too long.
33	Normal	Ring test sequence - Used in IMTS ring cycle. If no answer from mobile, push sequence start switch to recover from no answer.
34	Normal	Ring test sequence - Used in IMTS ring cycle.
35	Error	Ring test sequence - IMTS answer too long if test sequence stops here.
36	Normal	Ring test sequence - Used in IMTS ring cycle.
37	Error	Ring test sequence - Acknowledge too short. Push SEQUENCE START switch to recover from this error.
40	Normal	Conversation state - Connect made in IMTS mode.
41	Error	Conversation state - Answer too short in IMTS mode.
42	Error	Conversation state - No 2150Hz in disconnect burst if test sequence stops here.
43	Normal	Transient state - Checks length of individual 2150Hz burst in disconnect sequence.

FUNCTIONAL STATE TABLE (cont'd)

STATE	FUNCTION	DESCRIPTION
44	Normal	Transient state - Checks length of individual 1336Hz pulse burst in disconnect sequence.
45	Error	Disconnect state - Total disconnect burst too short if test stops here.
46	Error	Disconnect state - Individual tone bursts if disconnect cycle too short.
47	Normal	IMTS mobile-to-land sequence - Generate typical terminal delay before sending seize burst.
50	Error	IMTS mobile-to-land sequence - Stops here if connect too long. Push sequence START switch to recover from this error.
51	Error	IMTS mobile-to-land sequence - No guard tone after connect burst. Push sequence START switch to recover from this error.
52	Error	IMTS mobile-to-land sequence - Connect burst too short. Push sequence START switch to recover from this error.
53	Error	IMTS mobile-to-land sequence - Guard tone too short. Push sequence START switch to recover from this error.
54	Normal	IMTS mobile-to-land sequence - Seize burst sent to head in this state.
55	Error	IMTS mobile-to-land sequence - No ANI or ANI started late.
56	Normal	Transition state - Start non-MTS dialing sequence.
57	Normal	Read state - Reads IMTS ANI.
60	Normal	Dial tone state - High frequency dial tone sent to head.
61	Normal	MTS dial sequence - MTS reset dial number delayed in this state.
62	Error	IMTS mobile-to-land dialing sequence - ANI started too soon.
63 to 77	Not Used	

**3. GLOSSARY OF TERMS (TABLE 4-2)**

TERM	DEFINITION
ADDR	Address or Adder
ADVDT	Advance Digit
ANI	Automatic Number Identification
ANICP	IMTS ANI Complete
ANIIE	IMTS ANI Enable
ANISE	SMART ANI Enable
ASEQ	Automatic Sequence
BCF	Bit Counter Full
BRC	Bit Rate Clock
CH	Channel
CK	Check-Clock
CL	Clear
COM	Common
COMNO	Complete Number
COMP	Complete
DON	Dial Off Normal
DPC	Dial Pulse Contacts
EN	Enable
ENRO	Enable Readout
EOT	End of Transmission
EXT	External
FSK	Frequency Shift Keying
FW	Frame Word
GND	Ground
GRD	Guard
IMTS	Improved Mobile Telephone Service (IMTS Operation)
INV	Inverted (Inverse)
LSB	Least Significant Bit
MUX	Modulation
MPX	Multiplex
MSB	Most Significant Bit
MTS	Mobile Telephone Service (MTS Operation)
OCF	Output Counter Full
PEROR	Parity Error
PLL	Phase-Locked Loop
PROM	Programmed Read Only Memory
PWR	Power
RERO	Reset Readout
RCC/1500	Radio Common Carrier 1500Hz Selected
RCC/2805	Radio Common Carrier 2805Hz Selected
RTN	Return
RX	Receive
S or ST	Start
SCNT	Scan Test
SDIL	Start Dial

TERM	DEFINITION
SEQS	Sequence Start
SMRT	Smart Control Line
SPKR	Speaker
SPY or SUP	Supply
S.T.	Self Test
SW	Switch
SYNC	Synchronize
TKEY	Transmit Key
TN	Tone
TNOFF	Tone Off
TNON or TONON	Tone On
TX	Transmit
VCO	Voltage Controlled Oscillator
VM	Voltmeter
VOL	Volume
●	And Function
+	Or Function
—	Not (Example: ASEQ = Not Automatic Sequence)

4. CONTROL LOGIC STATE SEQUENCE DIAGRAM

4.01 The control logic in the test set follows specific sequences depending on the input signals supplied. The control logic state sequence diagram is a map showing how the control logic reacts to given inputs. A STATE SEQUENCE readout is provided on the front panel of the test set to show the present state of the test. The diagram and STATE readout allow the use of the manual mode of the test set. This mode is used to stop the test procedure at selected points. It can be used in any state but the set will continue stepping through the sequence until one of these selected points is reached. If, at a time, the conditions for a step are not fulfilled, the test set will wait in that state. This is one of the two failure indication modes. The other failure indicator is a branch to an error state. The error states can usually be side-stepped in order to continue the test.

4.02 The control logic state sequence diagram shows the inputs that affect each state in the form of an equation. The equation is read by considering each dot as an AND, and each plus sign as an OR. Thus $C \cdot D + E \cdot F$ would be read as C and D or E and F. Instead of letters the diagram uses abbreviations

to denote various input signals. A chart of the abbreviations and their meaning is supplied (refer to Glossary of Terms). This is how manual mode branches may be recognized as the abbreviations for the automatic sequence part of the equation. A bar over a term means it is the negative of the term, or in effect a signal must not be present to satisfy the term. The numbers assigned to each branch show the maxterm of the control logic board involved in each transition. This information is only of use when troubleshooting the set. The durations of the A and B timers are shown

in table 4-3. These times can readily be changed if required. Contact the factory for details.

4.03 When using the test set to troubleshoot a control unit the indicators are used to determine why a condition is not met (an error indicated). All signaling is audible, so that the operator can listen to the sequence. If the tones sound normal, the tone decoder output lamps will indicate the frequencies. If they are on frequency, there is probably a timing error.

TABLE 4-3
IMTS TIMING

RF-4950 TEST SET		RF-4950	BELL SPECIFICATION	
ERROR STATE		LIMIT	LIMIT	NOMINAL
06	Does not stop scan in time upon receipt of idle tone.	512	160	—
16	Guard tone too long or no connect burst after guard.	704	700	350
23	Acknowledge does not start in time.	290	None	None
32	Acknowledge too long	1008	1000	750
35	Answer interval too long.	768	763	400
37	Acknowledge too short	500	500	750
41	Connect interval too short.	286	287	400
45	Disconnect burst too short.	480	500	750
46	Disconnect tone intervals too short.	20	20	25
50	Mobile-base connect too long.	64	63	50
52	Mobile-base connect too short.	49	37	50
53	Guard tone too short.	250	250	350
55	ANI starts too late.	320	300	250
62	ANI starts too soon.	90	100	250
—	Interdigit time (minimum)	130	130	190

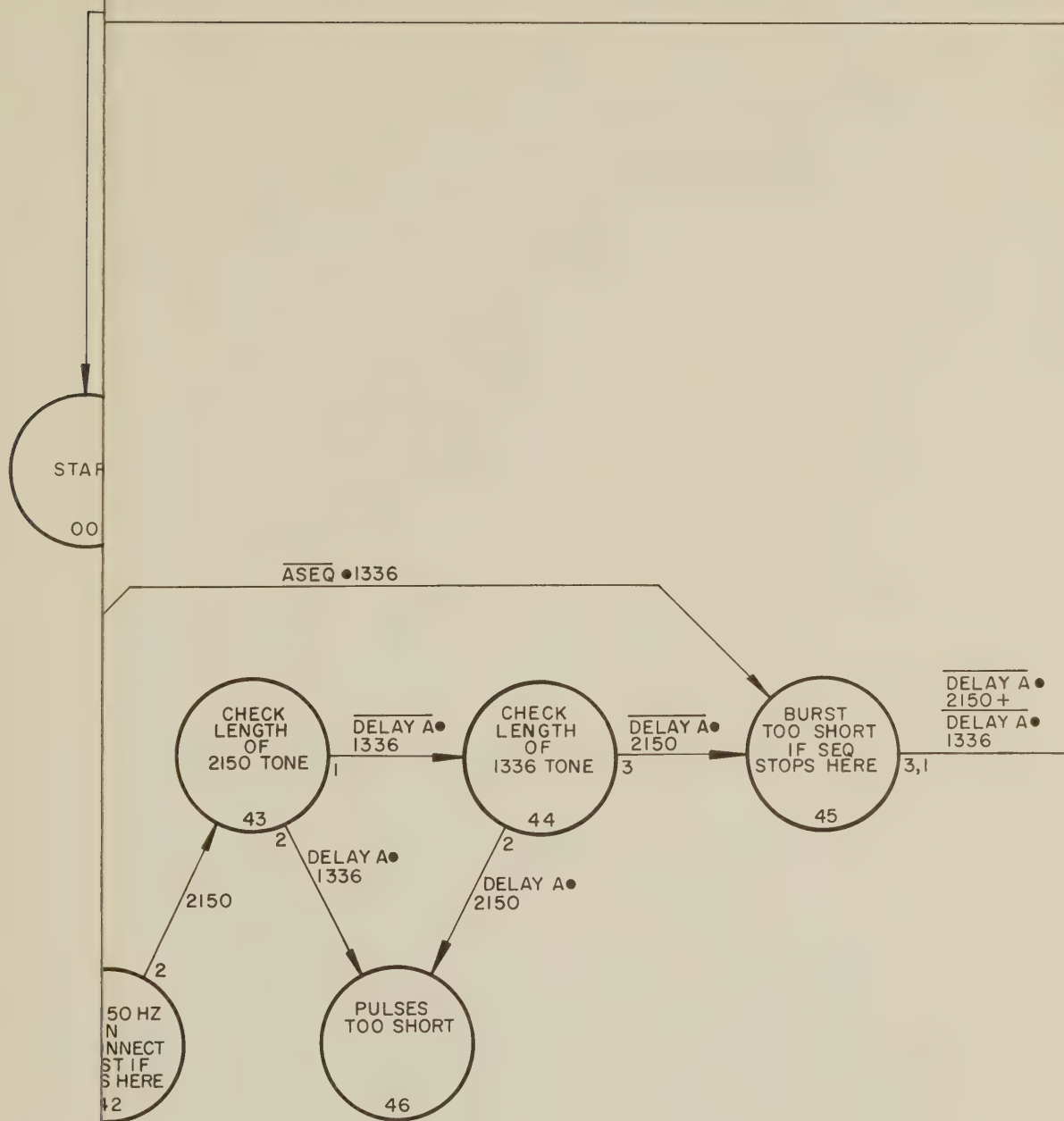


Figure 4-1. Control Logic State Sequence Diagram

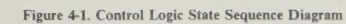
to denote various input signals. A chart of the abbreviations and their meaning is supplied (refer to Glossary of Terms). This is how manual mode branches may be recognized as the abbreviations for the automatic sequence part of the equation. A bar over a term means it is the negative of the term, or in effect a signal must not be present to satisfy the term. The numbers assigned to each branch show the maxterm of the control logic board involved in each transition. This information is only of use when troubleshooting the set. The durations of the A and B timers are shown

in table 4-3. These times can readily be changed if required. Contact the factory for details.

4.03 When using the test set to troubleshoot a control unit the indicators are used to determine why a condition is not met (an error indicated). All signaling is audible, so that the operator can listen to the sequence. If the tones sound normal, the tone decoder output lamps will indicate the frequencies. If they are on frequency, there is probably a timing error.

TABLE 4-3
IMTS TIMING

RF-4950 TEST SET		RF-4950	BELL SPECIFICATION	
ERROR STATE		LIMIT	LIMIT	NOMINAL
06	Does not stop scan in time upon receipt of idle tone.	512	160	—
16	Guard tone too long or no connect burst after guard.	704	700	350
23	Acknowledge does not start in time.	290	None	None
32	Acknowledge too long	1008	1000	750
35	Answer interval too long.	768	763	400
37	Acknowledge too short	500	500	750
41	Connect interval too short.	286	287	400
45	Disconnect burst too short.	480	500	750
46	Disconnect tone intervals too short.	20	20	25
50	Mobile-base connect too long.	64	63	50
52	Mobile-base connect too short.	49	37	50
53	Guard tone too short.	250	250	350
55	ANI starts too late.	320	300	250
62	ANI starts too soon.	90	100	250
—	Interdigit time (minimum)	130	130	190





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